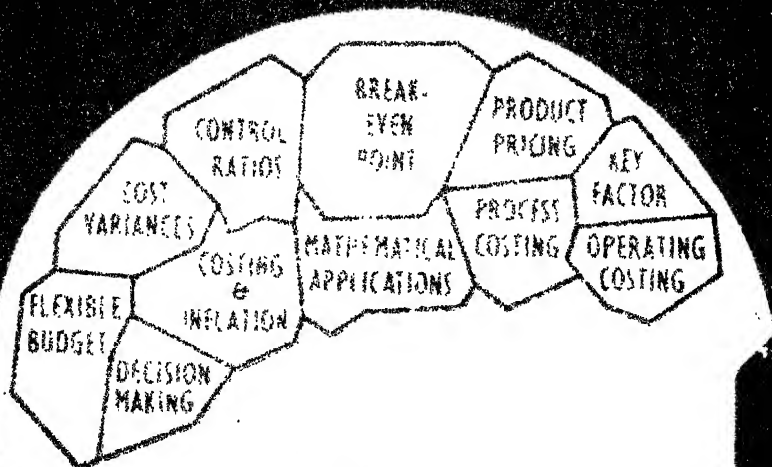


Advanced Cost and Management Accounting

Problems and Solutions



**V K Saxena
C D Vashist
SIXTH EDITION**

ADVANCED COST AND MANAGEMENT ACCOUNTING
PROBLEMS AND SOLUTIONS
(Advanced Cost Accounting)

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Under combination A, two separate books are available—one book containing "Text" only and the other "Problems and Solutions" only. However, combination B contains paper-wise books (containing theory, problems and exercises) and covering entire syllabi of two papers each of ICWA (Inter) and ICWA (Final). Readers are advised to follow these guidelines before purchasing the above books as the material is common in the two combinations.

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Advanced Cost And Management Accounting Problems and Solutions

(Advanced Cost Accounting)

[For I.C.W.A. (Inter & Final), C.A. (Inter & Final), Company Secretaries (Inter.), C.A.I.I.B., B.B.M., B.B.A., M.B.A., M.Com. and B.Com. (Hons.) Examinations]

V.K. SAXENA

M.Com., F.I.C.W.A.

Manager (Cost)

Bharat Heavy Electrials Ltd., New Delhi.

C.D. VASHIST

Director (Cost)

Department of Company Affairs

(COST AUDIT BRANCH)

New Delhi



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Preface to the Sixth Edition

We have pleasure in presenting the Sixth Revised and Enlarged Edition of the book "Advanced Cost and Management Accounting—Problems and Solutions". The sale of this edition was so brisk that it was out-of-stock within short space of time from the date of its publication. For this thumping success, we are really grateful both to faculty members and students. This has proved beyond doubt that the students appearing for the following examinations have found the book extremely useful :

- ☐ Institute of Chartered Accountants of India
- ☐ Institute of Cost and Works Accountants of India
- ☐ Chartered Institute of Management Accountants (CIMA) London
- ☐ Institute of Company Secretaries
- ☐ Institute of Bankers
- ☐ M.Com., M.B.A. and B. Com. (Hons)

This book on problems and solutions is a complimentary to the main book "*Advanced Cost and Management Accounting—Text*". 'Text' lays focus on conceptual understanding, whereas "Problems and Solutions" demands the practical applications of such concepts.

A large number of problems (741 in number) selected from past examination papers of various professional bodies (including CIMA London) have been added at the end of Appendix of this book. *This is the only book which contains both November and December 1990 problems of C.A. (Inter and Final) examinations.*

The salient features of this edition are as under :

- 741 problems up to May/June, 1991 Examinations of various professional bodies have been included.
- Out of this, 109 problems relate to *C.I.M.A. (London)* Examinations (Stages 2, 3 and 4).
- This is the only book which includes both November and December 1990 examinations problems of C.A. (Inter and Final), besides latest questions of the Institute.
- Special care has been taken to meet the requirements of all levels of students appearing for professional examinations such as *Chartered Accountancy, Cost and Works Accountancy, Company Secretaries, Bankers, etc.*
- This book is very useful for students as it has wealth of material on wide spectrum of problems on Cost and Management Accounting.
- It is an indispensable book for students appearing for various professional examinations.
- It is a compact and comprehensive book with most affordable price for students.

Constructive suggestions for improvement of this book are solicited from the readers.

V.K. SAXENA
C.D. VASHIST

Preface To the First Edition

The thumping success and increasing patronage of our text book "Advanced Cost Accounting" and the constant demand from the students encouraged us to write the present book titled "Advanced Cost and Management Accounting — Problems and Solutions" particularly with reference to the requirement of revised syllabi of Institute of Cost and Works Accountants, Institute of Chartered Accountants and Institute of Company Secretaries.

It is assumed that readers have no prior knowledge of Cost and Management Accounting and no advanced mathematical expertise. We have attempted a trend analysis of the past examination papers of a professional institute and noticed that more than 70% of the questions are set on practical problems. It is, therefore, evident that a student cannot think of passing any professional examination in Cost and Management Accounting without complete mastery of different types of problems. Keeping in view the emerging trends in Cost and Management Accounting and latest thinking on the subject, the following topics have been given special treatment in this book :

- * Decision-Making Problems

- * Costing and Inflation

Mathematical Applications to managerial problems such as learning curve, CVP analysis under situation of uncertainty Probability application and equated values.

- * Production, Productivity and Cost Effectiveness.

The Special Features of this book are summarised below :

- (i) The only book which covers 100% syllabi of different professional examinations.
- (ii) It contains more than 470 latest problems selected from different professional examinations such as ICWA, ICMA (London) CA & CS pertaining to the period 1981-87.
- (iii) All the problems have been suitably sectionalised and properly labelled.
- (iv) Special emphasis has been laid on decision-making problems relating to CVP analysis under situation of uncertainty, learning curve, probability applications, inflation accounting, production, productivity and cost effectiveness and other mathematical applications to managerial problems.
- (v) Compact and comprehensive book with affordable price for students.
- (vi) Advanced problems have been marked with asterisk (*).

- (vii) It contains detailed analysis of past examination trend showing that this book alone can help you to pass the examination.
- (viii) The problems have been solved in non-conventional manner. For example, model steps approach has been adopted for solving problems of variance analysis.
- (ix) Suggested approach has been given for difficult problems. This enables the student to develop the idea of solving complex problems.
- (x) It exposes the students to a wide variety of problems.

This book is primarily the revised problem portion of Advanced Cost Accounting. This section has been brought out separately to reduce size as well as price of the first edition. It is specifically designed to provide sound understanding of the intricacies of solving practical problems relating to Cost and Management Accounting. It is written in the form of self-study course with plenty of problems to gain confidence in solving them.

We are thankful to Sarvashri Jugal Kishore Puri, B. Com. (Hons) FICWA (Gold Medalist), ICAS and Member, Central Council of ICWA and D.C. Bajaj AICWA, ICAS, Chairman NIRC of ICWA for their encouragement and professional advice. We are also thankful to various Institutes for allowing us to reproduce past examination questions.

We are indebted to our fathers—Late S/Shri Sham Sunder Lal Saxena and Yog Raj Vashist—who left behind them sufficient to inspire us to do hard work with sincerity, dedication and determination.

Much of the credit for the successful completion of this book goes to our mothers--Smt. Suraj Mukhi and Smt. Harbansi Devi. They sustained the idea of writing the book with memorable dedication, when it was in its infancy. At times there was darkness all around and there was no hope and strength. At that time, they were the only companions.

Finally and most importantly we thank our wives—Usha Saxena and Adarsh Vashist and our children—Will, Kanu (Saxena) Shrish, Anish and Urvish (Vashist) for providing love, enjoyment, encouragement and welcome distractions when the book writing was in progress.

We take this opportunity to place on record our heartiest thanks to M/s Sultan Chand & Sons for ably and co-operatively bringing out this book. Finally, the authors count heavily upon the constructive suggestions and feedback from students for improvement of this book.

V.K. SAXENA
C.D. VASHIST

Contents

<i>Chapter</i>	<i>Page Nos.</i>
Trend Analysis, Summary of Basic Steps & Formulae etc.	(xii) – (xxviii)
1. Materials	P-1·1—P-1·41
Inventory Levels	P-1·1
Valuation of Materials	P-1·11
Miscellaneous	P-1·34
2. Labour	P-2·1—P-2·31
Labour Cost	P-2·1
Remuneration and Incentives	P-2·5
Labour Turnover	P-2·23
3. Overheads	P-3·1—P-3·54
Departmentalisation of Overheads	P-3·1
Computation of Overhead Rates	P-3·9
Under/Overabsorbed Overheads	P-3·34
Effect of Overhead on Profit	P-3·40
Miscellaneous	P-3·41
4. Cost Book-keeping	P-4·1—P-4·27
Cost Control Accounts and Integral Accounts	P-4·1
Reconciliation of Cost Accounts with Financial Accounts	P-4·20
5. Unit Costing, Job Costing and Contract Costing	P-5·1—P-5·45
Cost Sheet	P-5·1
Production Account	P-5·14
Job Costing	P-5·17
Contract Costing	P-5·33
6. Process Costing	P-6·1—P-6·54
Treatment of Normal and Abnormal Loss/Effectiveness	P-6·1
Equivalent Production	P-6·22
Inter-process Profits	P-6·47
7. Operating Costing	P-7·1—P-7·38
Transport Costing	P-7·1
Power House Costing	P-7·24
Hotel Costing	P-7·26
Hospital Costing	P-7·36
8. Joint Products and By-Products	P-8·1—P-8·30
Simple Problems	P-8·1
Apportionment of Joint Costs	P-8·1
Miscellaneous	P-8·26

<i>Chapter</i>	<i>Page Nos.</i>
9. Marginal Costing and Cost-Volume- Profit Relationship	P-9·1—P-13·2
Steps for solving Marginal Costing Problems	P-9·1
Break-even Analysis	P-9·2
Break-even Charts	P-9·43
Key Factors	P-9·48
Effect of Change in Cost, Volume and Price	P-9·64
Determination of Suitable Product-mix	P-9·84
Merging the Two Plants	P-9·116
Absorption Costing vs. Marginal Costing	P-9·122
10. Decision-Making	P-10·1—P-10·151
Make or Buy Decisions	P-10·1
Accepting/Quoting for an Order or Contract	P-10·15
Expand or Contract	P-10·27
Accepting/Rejecting an Export Order	P-10·32
Modernisation Decisions	P-10·43
Production Decisions	P-10·54
Marketing Decisions	P-10·82
Cost Indifference Point	P-10·103
Choice of Best Alternative	P-10·108
11. Budgetary Control	P-11·1—P-11·92
Flexible Budget	P-11·1
Functional Budgets	P-11·20
Budgeted Income Statement	P-11·60
Responsibility Accounting	P-11·71
Miscellaneous	P-11·79
12. Standard Costing—Variance Analysis	P-12·1—P-12·84
Direct Material Variances	P-12·1
Direct Labour Variances	P-12·11
Overhead Variances	P-12·13
Sales Variances	P-12·18
Investigation of Variances	P-12·21
Miscellaneous	P-12·24
Ratios	P-12·81
13. Use of Costs in Pricing Decisions	P-13·12—P-13·62
Return on Investment Pricing	P-13·1
Inter-division Transfer Pricing	P-13·27

14. Costing and Inflation	P-14.1—14.23
15. Mathematical/Statistical Applications to Managerial Problems	P-15.1—P-15.65
Learning Curve	P-15.1
Equated Value and Probability	P-15.6
16. Production, Productivity and Cost Effectiveness	P-16.1—P-16.22
Appendix A—Problems from Latest Examinations	A.1—A.497
C.I.M.A. (London) November 1987	A-1
C.A. Inter May 1988	A-9
C.A. Inter November 1988	A-15
C.A. Final May 1988	A-18
C.A. Final November 1988	A-27
→ C.I.M.A. (London) May 1988	A-31
→ C.I.M.A. (London) November 1988	A-48
I.C.W.A. Inter June 1988	A-59
I.C.W.A. Final June 1988	A-73
I.C.W.A. Inter December 1988	A-89
I.C.W.A. Final December 1988	A-102
C.S. Inter June 1988	A-121
C.S. Inter December 1988	A-122
→ C.I.M.A. (London) May 1989	A-125
C.A. Inter May 1989	A-136
C.A. Final May 1989	A-142
I.C.W.A. Inter June 1989	A-151
I.C.W.A. Final June 1989	A-159
C.S. Inter June 1989	A-168
→ C.I.M.A. (London) November 1989	A-172
C.A. Inter November 1989	A-199
C.A. Final November 1989	A-205
I.C.W.A. Inter December 1989	A-215
I.C.W.A. Final December 1989	A-225
C.S. Inter June 1989	A-244
→ C.I.M.A. (London) May 1990	A-248
C.A. Inter May 1990	A-276
C.A. Final May 1990	A-283
C.S. Inter June 1990	A-296
I.C.W.A. Inter June 1990	A-301
I.C.W.A. Final June 1990	A-313
C.A. Inter November 1990	A-342
C.A. Inter December 1990	A-348
C.S. Inter December 1990	A-355
I.C.W.A. Inter December 1990	A-360
C.A. Final November 1990	A-368
C.A. Final December 1990	A-378
I.C.W.A. Final December 1990	A-389
→ C.I.M.A. (London) November 1990	A-409
C.A. Inter May 1991	A-433
I.C.W.A. Inter June 1991	A-441
C.S. Inter June 1991	A-451
C.A. Final May 1991	A-452
I.C.W.A. Final June 1991	A-460
→ C.I.M.A. (London) May 1991	A-478
Appendix B Preparing for Professional Examinations	

Summary of Chapterwise Problems taken from various professional examinations

S.No.	Chapter Title	No. of Pages	ICWA (Inter)	ICWA (Final)	CIMA (London)	C.A. (Inter)	C.A. (Final)	C.S.	Total
—	Summary of Model Steps/Formulae	8	—	—	—	—	—	—	—
1.	Materials	40	11	8	1	6	6	3	35
2.	Labour	29	14	4	—	9	1	1	29
3.	Overhead	53	27	2	2	11	—	7	49
4.	Cost Book-keeping	27	7	2	1	6	4	1	21
5.	Job Costing & Contract Costing	43	15	4	2	11	4	6	42
6.	Process Costing	54	10	4	8	9	2	6	39
7.	Operating Costing	38	6	6	4	4	2	2	24
8.	Joint Products and By-Products	30	4	8	3	6	2	1	24
9.	Marginal Costing & CVP Analysis	129	26	20	17	12	20	15	110
10.	Decision Making	149	2	56	18	3	26	5	110
11.	Budgetary Control	91	10	16	8	7	13	1	55
12.	Standard Costing—Variance Analysis	84	14	17	16	10	11	4	72
13.	Use of Costs in Pricing Decisions	62	1	25	7	—	4	—	37
14.	Costing and Inflation	23	—	13	—	—	—	—	13
15.	Mathematical Application to Managerial Problems	65	—	35	22	—	2	—	59
16.	Production, Productivity and Cost Effectiveness	21	20	2	—	—	—	—	22
	Appendix A	497							
	Preface, Contents, Trend Analysis and Appendix—B	23							
Total		1466	167	222	109	94	97	52	741

COST ACCOUNTING

Analysis the past examination questions relating to C.A. (Inter)

S. No. Chapters	1989				1988				1987				Total
	May		Nov.		May		Nov.		May		Nov.		
	P	T	P	T	P	T	P	T	P	T	P	T	
1. Material	1	—	$\frac{1}{2}$	$\frac{1}{2}$	—	—	—	1	—	1	1	—	$2\frac{1}{2}$
2. Labour	—	1	—	—	—	—	—	—	—	—	—	—	1
3. Overhead	—	—	$\frac{1}{2}$	$\frac{1}{2}$	1	—	—	—	1	—	—	—	$2\frac{1}{2}$
4. Cost Book- Keeping	1	—	1	—	1	—	—	—	—	1	—	—	3
5. Joint Product and By-Product	—	—	—	1	—	—	—	1	$\frac{1}{2}$	$\frac{1}{2}$	2	—	$2\frac{1}{2}$
6. Process Costing	1	—	—	—	—	—	—	—	1	—	—	—	2
7. Marginal Costing & CVP Analysis	1	—	1	—	$1\frac{1}{2}$	$\frac{1}{2}$	2	—	1	—	—	—	$6\frac{1}{2}$
8. Budgetary Control	—	—	—	1	—	—	1	—	—	—	—	—	1
9. Standard Costing	1	—	1	—	—	—	1	—	1	—	2	—	6
10. Short Notes/Misc. Theory	—	1	—	—	—	2	—	1	—	—	—	2	6
Total	5	2	4	3	$4\frac{1}{2}$	$2\frac{1}{2}$	4	3	$4\frac{1}{2}$	$2\frac{1}{2}$	5	2	27
Percentage	72	28	57	43	64	36	57	43	64	36	71	29	64
													36

'P' stand for problems and 'T' stands for theory

COST SYSTEMS AND COST CONTROL

Analysis of past examinations questions relating to C.A. (Final)

S. No. Chapters	1989			1988			1987			Total	
	May		Nov.	May		Nov.	May		Nov.	P	T
	P	T		P	T		P	T			
1. Cost Book Keeping	—	—	—	—	—	—	—	—	—	—	—
2. Job Costing	—	—	—	—	2	—	—	—	—	—	1
3. Joint Product & By-Product	—	—	—	—	—	—	—	—	—	—	2
4. Marginal Costing & CVP Analysis	—	—	—	—	—	—	—	—	—	1	—
5. Decision Making	3	2	—	—	—	1	—	1	—	—	5
6. Budgetary Control	—	—	—	—	2	3	—	1	—	2	13
7. Standard Costing	1	—	—	—	—	1	—	1	—	—	2
8. Short Notes/ Misc.	1	1	—	—	1	—	—	—	—	—	4½
Total	5	1	5	1	5	1	—	1	—	1	6
Percentage	83	17	83	17	83	17	4½	1	14½	29½	6½
'P' stand for Problems and T stands for Theory											18

(xvi)

COST ACCOUNTANCY (PRIME COST & OVERHEAD)
Analysis of past Examination Questions relating to I.C.W.A. (Inter)

S. No. Chapters	1989				1988				1987				Total	
	June		Dec.		June		Dec.		June		Dec.			
	P	T	P	T	P*	T*	P	T	P	T	P	T	P	T
1. Material	—	2	$\frac{1}{2}$	1	1	1	1	1	1	1	1	1	$3\frac{1}{2}$	6
2. Labour	$\frac{2}{3}$	1	$\frac{1}{2}$	$1\frac{1}{2}$	1	2	$\frac{1}{2}$	$1\frac{1}{2}$	1	1	1	1	$3\frac{2}{3}$	$6\frac{1}{6}$
3. Overhead	$\frac{1}{3}$	1	—	$1\frac{2}{3}$	1	1	2	$\frac{1}{2}$	$\frac{1}{2}$	2	$1\frac{1}{2}$	$3\frac{1}{2}$	$4\frac{1}{3}$	$8\frac{1}{6}$
4. Cost Sheet	1	—	$\frac{1}{3}$	—	1	1	1	1	$\frac{1}{2}$	1	1	1	$4\frac{1}{6}$	2
5. Misc. (short notes etc.)	1	1	$\frac{2}{3}$	2	1	1	1	1	1	1	1	1	$1\frac{2}{3}$	7
Total	3	5	$\frac{1}{3}$	$5\frac{2}{3}$	3	5	$3\frac{1}{2}$	$4\frac{1}{2}$	3	5	$2\frac{1}{2}$	$5\frac{1}{2}$	$17\frac{1}{2}$	$30\frac{5}{6}$
Percentage	38	62	33%	66%	38	62	44	56	37	63	31	69	36	64

'P' stand for Problems and T stands for Theory

COST AND MANAGEMENT ACCOUNTING (METHODS AND TECHNIQUES)

Analysis of past examination questions relating to I.C.W.A. (Inter)

No. Chapters	1989			1988			1987			Total	
	June		Dec.	June		Dec.	June		Dec.		
	P	I	P	P	T	P	P	T	P	T	P
Material											
Labour											
Overheads											
Cost Book-keeping (including Reconciliation)											
Job Costing & Central Costing	1		1		1						
Process costing	1		1								
Operating costing	1										
Joint Product & By-Product	1										
Marginal Costing & Cost Volume Profit Analysis	2		2		1						
Decision making	1		1		1						
Budgetary Control			1		1						
Standard Costing and Variance Analysis	1		1		1						
Uniform Costing & Interfirm Comparison	1										
Pricing											
Reporting											
Cost Control & Cost Reduction											
Misc. (including short notes etc.)											
Total	5	3	5	3	5	4	1	4	1	2	24
Percentage	62	38	62	38	60	26	44	50	62	38	59

P stands for Problems and I stands for Theory

ADVANCED COST AND MANAGEMENT ACCOUNTANCY : ANALYSIS & CONTROL

Analysis of past Examination Questions relating to I.C.W.A. (Final)

S. No.	Chapters	1989			1988			1987			Total		
		June		Dec.	June		Dec.	June		Dec.	June		Dec.
		P	T	P	T	P	T	P	T	P	T	P	T
1.	Labour												
2.	Overhead												
3.	Process Costing												
4.	Operative Costing												
5.	Joint Products/ By-Products.												
6.	Marginal Costing	1		3			1			1		2	
7.	Decision-Making	5		3		2	1			1		9	1
8.	Budgetary Control	1			1	3			1	2		18	1
9.	Std. Costing & V. Analysis									1½	½	2½	1½
10.	Pricing			1		2						3	
11.	Mathematical Application to Managerial Problems					1				½		1½	
12.	Costing & Inflation												
13.	Misc. (including short notes etc.)	1		1			1		3		½		6½
Total		7	1	7	1	7	2	5	4	6	1	39	10
Percentage		88	12	88	12	88	22	56	44	86	14	80	20

'P' stands for Problem and 'T' stands for Theory

Mathods, Techniques & Applications
Analysis of part examination questions relating to I.C.W.A. (Final)

S. No. Chapters	1989				1988				1987				Total	
	June		Dec.		June		Dec.		June		Dec.			
	P	T	P	T	P*	T*	P*	T*	P	T	P	T		
1. Labour													2	—
2. Overhead									1				1	—
3. Joint Products/ By-Products									1				1	—
4. Marginal Costing & CVP Analysis									1				2	—
5. Decision-Making	1		1		1		1		2		1		7	—
6. Budgetary Control					1		1			1	1½		2½	2
7. Variance Analysis	1						1						2	—
8. Pricing		½	1							1			1	½
9. Costing and Inflation	½	½	1		1½	½	1		1		1		6½	
10. Mathematical applica- tion to Marginal Problems	4		3		4		3		2		2½	½	18½	½
11. Miscellaneous		½		2	1				½	½	½	2½	1½	5½
Total	6½	1½	6	2	8½	½	6	1	7½	2½	6½	2½	45½	9½
Percentage	91	9	75	25	94.4	5.6	87.5	12.5	75	25	69	31	83	17

'P' stands for Problems and 'T' stands for Theory

BASIC STEPS AND FORMULAE

The authors primarily emphasize to avoid use of formulae as far as possible. Still, the use of formulae cannot be completely done away with. Given below is a gist of steps/formulae/basic knowledge which must be kept in mind before attempting the solution of problems relating to different chapters.

1. Material

1.1 Maximum Level = Reorder level + Reordering Quantity – Minimum consumption during the period required to obtain delivery.

Or

$$RL + RQ - MnC$$

1.2 Minimum Level = Reorder Level – (Normal usage × Average Delivery per period Time)

Or

$$RL - (NU \times ADT)$$

1.3 Average Stock Level = $\frac{\text{Maximum Level} + \text{Minimum Level}}{2}$

Or

$$\text{Minimum Level} + \frac{1}{2} \text{ Reorder Quantity}$$

1.4 Reorder Level = Maximum Reorder Period × Maximum Usage

Or

$$MRP \times MU$$

$$= \text{Normal Usage} \times (\text{Minimum Stock Period} + \text{Average Delivery Time})$$

Or

$$NU \times (MnSP + ADT)$$

$$= \text{Safety Stock} + \text{Lead Time Consumption}$$

1.5 Danger Level = Minimum Consumption × Emergency Delivery Time

1.6 Economic Order Quantity

$$= \sqrt{\frac{2 \times \text{Annual consumption} \times \text{Buying cost per order}}{\text{Cost per unit} \times \text{Storage and carrying cost rate}}}$$

1.7 Inventory Turn-over Ratio = $\frac{\text{Material consumed}}{\text{Average inventory}}$

1.8 Inventory Turnover Period

$$= 365 \div \text{Inventory Turnover Ratio}$$

2. Labour

2.1 Time Rate System

2.2 Straight Piece Rate System

Earnings = Number of units \times Piece Rate per unit

2.3 Differential Piece Rate System**2.3.1 F.W. Taylor's System**

Earnings = 80% of piece rate when below standard

Earnings = 120% of piece rate when at or above standard

2.3.2 Merrick Differential Piece Rate System

<i>Efficiency</i>	<i>Payment</i>
Up to 83 $\frac{1}{3}$ %	Ordinary piece rate
83 $\frac{1}{3}$ to 100%	110% of ordinary piece rate
Above 100%	130% of ordinary piece rate

2.4 Combination of Time and Piece Rate**2.4.1 Gantt Task & Bonus System**

<i>Output</i>	<i>Payment</i>
Output below standard	Guaranteed time rate
Output at standard	120% of time rate
Output above standard	120% of piece rate

2.4.2 Emerson Efficiency System

Earning is calculated as follows .

<i>Efficiency</i>	<i>Payment</i>
Below 66 $\frac{2}{3}$ %	No bonus, only guaranteed time rate is paid.
66 $\frac{2}{3}$ to 100%	Worker is paid by hourly rate for the time he actually works <i>plus</i> an increase in bonus according to degree of efficiency on the basis of step bonus rates. Bonus rate can be up to 20%.
Above 100%	120% of the wage rate <i>plus</i> additional bonus of 1% for each 1% increase in efficiency.

2.4.3 Bedaux Point System

Earnings = Hours worked \times Rate per hour .

$$\left(\frac{75}{100} \times \frac{\text{Bedaux points saved}}{60} \right) \times \text{Rate per hour}$$

2.4.4 Haynes Mani System

This system is similar to Bedaux Point System. Instead of Bedaux points saved, 'MANIT' (Man-minutes) saved are measured for payment of bonus. Bonus is distributed as follows :

50% bonus to the workers
 10% bonus to the supervisors
 40% bonus to the employer

2.5 Premium Bonus Plan

2.5.1 Halsey Premium Plan

$$\text{Earnings} = \text{Hours worked} \times \text{Rate per hour} + \left(\frac{50}{100} \times \text{Time saved} \times \text{Rate per hour} \right)$$

2.5.2 Halsey-Weir Premium Plan

$$\text{Earnings} = \text{Hours worked} \times \text{Rate per hour} + \left(\frac{33\frac{1}{3}}{100} \times \text{Time saved} \times \text{Rate per hour} \right)$$

2.5.3 Rowan System

$$\text{Earnings} = \text{Hours worked} \times \text{Rate per hour} + \left(\frac{\text{Time saved}}{\text{Time allowed}} \times \text{Hours worked} \times \text{Rate per hour} \right)$$

2.5.4 Barth Sharing Plan

$$\text{Earnings} = \text{Rate per hour} \times \sqrt{\text{Standard hours} \times \text{Hours worked}}$$

2.6 Labour Turnover Rate

$$2.6.1 \text{ Separation Method} = \frac{\text{Number of separations during the period}}{\text{Average number of workers during the same period}} \times 100$$

$$2.6.2 \text{ Replacement Method} = \frac{\text{Number of workers replaced in a period}}{\text{Average number of workers in the same period}} \times 100$$

$$2.6.3 \text{ Flux Method} = \frac{\text{No. of separations} + \text{No. of replacements}}{\text{Average number workers during the period}} \times 100$$

3. Overhead

$$3.1 \text{ Overhead Absorption Rate or Overhead Recovery Rate} = \frac{\text{Amount of overhead incurred}}{\text{Basis for absorption}}$$

$$3.2 \text{ Predetermined Overhead Rate} = \frac{\text{Budgeted overhead for the period}}{\text{Budgeted basis for the period}}$$

$$3.3 \text{ Blanket Overhead Rate} = \frac{\text{Overhead cost for the entire factory for the period}}{\text{Base for the period (Total labour hours, total machine hours, etc.)}}$$

- 3.4 Multiple Overhead Rate = $\frac{\text{Overhead allocated/appORTIONED to each Deptt.}}{\text{Corresponding base}}$
- 3.5 Variable portion in Semi-variable Overhead = $\frac{\text{Change in amount of expense}}{\text{Change in activity or quantity}}$

4. Contract Costing

- 4.1 When work on contract has not reasonably advanced, no profit is taken into account. In practice, no profit is calculated when work certified is less than $\frac{1}{4}$ th of the contract price.
- 4.2 When the work certified is more than $\frac{1}{4}$ th but less than $\frac{1}{2}$ of the contract price, following formula is used to determine the figures of profit to be credited to profit and loss account :

$$\frac{1}{4} \times \text{Notional profit} \times \frac{\text{Cash received}}{\text{Work certified}}$$

- 4.3 When the work certified is more than $\frac{1}{2}$ of the contract price, but it is still not in the final stage, following formula is used to determine the figure of profit to be credited to profit and loss account :

$$\frac{1}{2} \times \text{Notional profit} \times \frac{\text{Cash received}}{\text{Work certified}}$$

- 4.4 When the contract is almost complete, an estimated total profit is determined by deducting aggregate of cost to date and estimated additional expenditure from contract price. A portion of this estimated total profit is credited to profit and loss account. The figure to be credited to profit and loss account is ascertained by adopting any of the following formulae :

$$4.4.1 \text{ Estimated total profit} \times \frac{\text{Works certified}}{\text{Contract price}}$$

$$4.4.2 \text{ Estimated total profit} \times \frac{\text{Cash received}}{\text{Contract price}}$$

$$4.4.3 \text{ Estimated total profit} \times \frac{\text{Cost of work to date}}{\text{Estimated total cost}}$$

$$4.4.4 \text{ Estimated total profit} \times \frac{\text{Cost of work to date}}{\text{Estimated total cost}} \times$$

$$\frac{\text{Cash received}}{\text{Work certified}}$$

4. Marginal Costing

- 5.1 Basic Marginal Cost Equation :

$$\text{Sales} - \text{Variable cost} = \text{Fixed cost} + \text{Profit}$$

$$\text{or } S - V = F + P$$

- 5.2 Sales - Variable cost = Contribution

$$\text{or } S - V = C$$

- 5.3 Contribution = Fixed cost + Profit

$$\text{or } C = F + P$$

$$5.4 \quad P/V \text{ Ratio} = \frac{\text{Sales} - \text{Variable cost}}{\text{Sales}} \times 100 \quad \text{or} \quad \frac{\text{Contribution}}{\text{Sales}} \times 100$$

$$5.5 \quad \frac{S(S-V)}{S} = F + P \quad \text{or} \quad S \times P/V \text{ Ratio} = F + P$$

$$\text{or} \quad S \times P/V \text{ Ratio} = \text{Contribution} \quad \text{or} \quad S = \frac{\text{Contribution}}{P/V \text{ Ratio}}$$

$$5.6 \quad P/V \text{ Ratio} = \frac{\text{Change in profit}}{\text{Change in sales}}$$

5.7 **Break-even Sales.** Break-even sales in the point of sales where contribution is just sufficient to meet the fixed cost, i.e., Sales—Variable cost=Fixed cost. At this point of sales, the profit is nil.

$$\text{or} \quad S - V = F$$

$$\text{or} \quad \frac{S(S-V)}{S} = F$$

$$\text{or} \quad S \times P/V \text{ Ratio} = F$$

$$\text{or} \quad BES = \frac{F}{P/V \text{ Ratio}}$$

$$5.8 \quad \text{Profitability} = \frac{\text{Contribution}}{\text{Key factor}}$$

$$5.9 \quad \text{Margin of Safety} = \text{Total sales} - \text{Break-even sales}$$

$$\text{Margin of Safety Ratio} = \frac{\text{Total sales} - \text{Break-even sales}}{\text{Total Sales}}$$

6. Variance Analysis

SUMMARY OF MODEL STEPS

6.1 Cost Variances

6.1.1 For Material Cost Variances

M_1 —Actual Cost of material used.

M_2 —Standard Cost of material used.

M_3 —Standard Cost of material, if it had been used in standard proportion.

M_4 —Standard material cost of output.

Calculation of Material Cost Variances

$$\text{Material Price Variance} = M_1 - M_2$$

$$\text{Material Mix Variance} = M_2 - M_3$$

$$\text{Material Yield Variance} = M_3 - M_4$$

$$\text{Material Cost Variance} = M_1 - M_4$$

$$\text{Material Usage or Volume Variance} = M_2 - M_4$$

6'1'2 For Direct Wage Variances

L₁—Actual payment made to workers for actual hours worked.

L₂—Payment involved, if the worker had been paid at standard rate.

L₃—Payment involved, if the workers had been used according to the proportion of standard gang and the payment had been made at standard rate.

L₄—Standard labour cost of labour hours utilized. Students should be very careful in finding the value of **L₄**. This step will have value when there is a difference between hours available and hours utilized.)

L₅—Standard labour cost of output achieved.

Calculation of Direct wage Variances

Wage Rate Variance $= L_1 - L_2$

Wage Gang Variance $= L_2 - L_3$

Wage Idle Time Variance $= L_3 - L_4$

Wage Yield Variance $= L_4 - L_5$

Wage Cost Variance $= L_1 - L_5$

Wage Efficiency Variance $= L_2 - L_5$

6'1'3 Variable Overhead Variances

VO₁—Actual variable overhead.

VO₂—Actual hours worked at standard variable overhead rate.

VO₃—Standard variable overhead for the production.

Calculation of Variable Overhead Variances

Variable Overhead Expenditure variance $= VO_1 - VO_3$

Variable Overhead Efficiency Variance $= VO_2 - VO_3$

Variable Overhead Variance $= VO_1 - VO_2$

6'1'4. For Fixed Overhead Variance

FO₁—Actual fixed overhead incurred.

FO₂—Budgeted fixed overhead for the period or standard fixed overhead allowance.

FO₃—Fixed Overhead for the days/hours available at standard rate during the period.

FO₄—Fixed Overhead for actual hours worked at standard rate.

FO₅—Standard fixed overhead for production

Calculation of Variances

Fixed Overhead Expenditure Variance $= FO_1 - FO_2$

Fixed Overhead Calendar Variance or fixed Overhead Idle Time Variance $= FO_4 - FO_5$

Fixed Overhead Capacity Variance	$=FO_3 - FO_4$
Fixed Overhead Efficiency Variance	$=FO_4 - FO_5$
Fixed Overhead Volume Variance	$=FO_5 - FO_6$

For making inference about Cost Variances (negative or positive)

If the value of the preceding step is more than the value of the following step, it will be a case of adverse or unfavourable variance. Alternatively, if the value of the preceding step is less than the value of the following step, it will be a case of favourable or positive variance.

6.2. Sales Variance

7.21. For Total Sales Margin Variance

SM_1 —Actual sales margin on actual sales.

SM_2 —Standard sales margin on actual sales.

SM_3 —Standard sales margin, if the actual sales had been in the ratio of standard sales mix.

SM_4 —Standard sales margin on standard sales mix or budgeted sales margin as per budget or standard.

Calculation of Variances

Sales Margin Price Variance	$=SM_1 - SM_2$
Sales Margin Mix Variance	$=SM_2 - SM_3$
Sales Margin Quantity Variance	$=SM_3 - SM_4$
Sales Margin Volume Variance	$=SM_2 - SM_4$

6.2.2 For Total Sales Value Variance

SV_1 —Actual sales value realised

SV_2 —Standard sales value of actual sales

SV_3 —Standard sales value of actual sales, if the sales had been in the ratio of standard sales mix.

SV_4 —Standard sales value of sales as per standard or budget.

Calculation of Variances

Sales Value Price Variance	$=SV_1 - SV_2$
Sales Value Mix Variance	$=SV_2 - SV_3$
Sales Value Quantity Variance	$=SV_3 - SV_4$
Sales Value Variance	$=SV_1 - SV_4$

For making inferences about Sales Margin Variances and Sales Value Variances (Negative or Positive)

Unlike cost variances, if the value of the preceding step is more than the value of the following step, it will be a case of favourable

positive variances. Alternatively, if the value of the preceding step less than the value of the following step, it will be a case of unfavourable or adverse variance.

3. Accounting methods for operation of standard costing

6'3'1. Partial Plan. Under this method, work-in-progress account is debited with actual cost and credited with standard cost of production. Material price variance is computed on goods completed and goods in progress.

6'3'2. Single Plan. Under this method, work-in-progress account is both debited and credited with standard cost of finished goods and inventory. Material price variance is computed on materials purchased.

6'3'3. Dual Plan. Cost ledger is kept at actual price and variances are analysed in subsidiary records for information of management.

4 Ratio Analysis

$$6'4'1 \text{ Efficiency Ratio} = \frac{\text{Output expressed in terms of standard hours}}{\text{Actual hours worked for producing that output}} \times 100$$

$$6'4'2 \text{ Activity Ratio} = \frac{\text{Actual output in standard hours}}{\text{Budgeted output in standard hours}} \times 100$$

$$6'4'3 \text{ Calendar Ratio} = \frac{\text{Actual number of working days in a period}}{\text{Number of working days in related budget period}} \times 100$$

$$6'4'4 \text{ Actual Capacity Usage Ratio} = \frac{\text{Actual hours worked}}{\text{Maximum possible hours in a period}} \times 100$$

$$6'4'5 \text{ Actual usage of budgeted capacity ratio} = \frac{\text{Actual working hours}}{\text{Budgeted hours}} \times 100$$

$$6'4'6 \text{ Standard capacity usage ratio} = \frac{\text{Budgeted hours}}{\text{Maximum possible number of working hours in budget period}} \times 100$$

Materials

[Inventory Levels 1'1—1'13 ; Valuation of Materials 1'14—1'23 ;
Miscellaneous 1'24—1'27.]

INVENTORY LEVELS

Savings due to EOQ

Problem 1'1. (a) Define inventory. What are the different types of inventory in industries ? Why is it important to control inventory ?

(b) A Purchase Manager has decided to place orders for minimum quantity of 500 Nos. of a particular item in order to get a discount of 10%. From the records, it was found out that in the last year orders each of size 200 Nos. have been placed. Given ordering cost—Rs. 500 per order, inventory carrying cost=40% of the inventory value and the cost per unit=Rs. 400, is the Purchase Manager justified in his decision ? What is the effect of his decision to the Company ?

[(C.A. Final, May 1986)]

Solution.

(a) Please refer to *Advanced Cost and Management Accounting—Text* by Saxena and Vashist.

$$(b) EOQ = \sqrt{\frac{2ab}{CS}}$$

$$\begin{aligned} \text{or} \quad & \sqrt{\frac{2 \times \text{Annual consumption} \times \text{Buying cost per order}}{\text{Cost per order} \times \text{Storage and carrying cost rate}}} \\ &= \sqrt{\frac{2 \times (8 \times 200) \times 500}{400 \times 40\%}} = \sqrt{\frac{16,00,000}{160}} = 100 \text{ Nos.} \end{aligned}$$

Number of orders = $1600 \div 100$ or 16 orders p.a.

(i) Cost of 16 orders

Ordering Cost (16 × 500)	Rs. 8,000
Carrying Cost of average inventory (100 × 160) ÷ 2	8,000
Purchase Cost (1600 × Rs. 400)	5,40,000
Total Cost of inventory	6,56,000

(ii) Last year's total inventory cost	
Ordering Cost ($8 \times \text{Rs. } 500$)	4,000
Carrying Cost ($200 \times 160 \div 2$)	16,000
Purchase Cost	6,40,000
Total Cost of inventory	6,60,000
	=====

(iii) Total inventory cost due to Purchase Manager's decision	
Minimum Qty. = 500 Nos. @ Rs. 360* per unit	
Carrying Cost = Rs. $360 \times 40\%$ or Rs. 144	
No. of Orders = $1600 \div 500$ or 3.2 say 4 orders	Rs.
Ordering cost ($4 \times \text{Rs. } 500$)	2,000
Carrying cost of average inventory ($500 \times 144 \div 2$)	36,000
Purchase Cost ($1600 \times \text{Rs. } 360$)	5,76,000
Total Cost of inventory	6,14,000

* (Rs. 400 – 10% of Rs. 400)

Effect of the decision of Purchase Manager to the Company

	Rs.
(i) Total inventory cost (EOQ level)	6,56,000
(ii) Total inventory cost (last year)	6,60,000
(iii) Total inventory cost due to Purchase Manager's Decision	6,14,000
Saving (Rs. 6,60,000 – 6,14,000)	46,000

It is noticed that total inventory cost due to Purchase Manager's decision is the minimum. Purchase Manager is justified in his decision as it resulted in maximum saving, i.e., Rs. 46,000.

EOQ with/without discount

Problem 12. A publishing house purchases 2,000 units of a particular item per year at a unit cost of Rs. 20, the ordering cost per order is Rs. 50 and the inventory carrying cost is 25%. Find the optimal order quantity and the minimum total cost including purchase cost.

If a 3% discount is offered by the supplier for purchases in lots of 1,000 or more, should the publishing house accept the order?

[I.C.W.A. Final (R.S.), June 1986; Dec. 1981 & June 1982—Similar
I.C.W.A. Inter December 1986—Similar]

Solution. EOQ without discount

$$= \sqrt{\frac{2ab}{CS}}$$

$$= \sqrt{\frac{2 \times 2,000 \text{ units} \times \text{Rs. } 50}{20 \times 0.25}} = 200 \text{ units}$$

Average inventory $(200 \div 2) = 100$ units	
Ordering Cost $(10 \times \text{Rs. } 50)$	Rs. 500
Carrying Cost of average inventory (100×5)	500
Purchase Cost $(2,000 \times \text{Rs. } 20)$	40,000
	<hr/>
	41,000
	<hr/>

EOQ with discount

Unit Cost after discount $= \text{Rs. } 20 - (3\% \text{ of } 20) = \text{Rs. } 19.40$	
Carrying Cost $= 25\% \text{ of Rs. } 19.40 = \text{Rs. } 4.85$	
Lot size $= 1,000$ units, i.e., 2 orders.	Rs.
Ordering Cost $(2 \times \text{Rs. } 50)$	100
Carrying Cost of average inventory $(500 \times \text{Rs. } 4.85)$	2,425
Purchase Cost $(2,000 \times \text{Rs. } 19.40)$	38,800
	<hr/>
	41,325
	<hr/>

The above computation shows that supplier's offer for 3% discount should not be accepted. However, higher discount should be negotiated with the supplier.

EOQ, ROL and Average Stock Level

Problem 13. Given the following data relating to one of the A class items, what inventory model do you suggest? What would be EOQ, ROL and average inventory under the suggested model? Annual demand $= 1,000$ units, Cost per item $= \text{Rs. } 25$, Ordering cost per order $= \text{Rs. } 20$ and Holding cost 40%. Past lead time (days) are 10, 8, 12, 13 and 7.
(C.A. Final, Nov. 1986)

Solution. Fixed order quantity system is the suggested inventory model for A class items.

$$\text{EOQ} = \sqrt{\frac{2 \times \text{Annual consumption} \times \text{Buying cost per order}}{\text{Cost per unit} \times \text{Storage and carrying cost rate}}}$$

$$= \sqrt{\frac{2 \times 1,000 \times 20}{25 \times 40\%}} = 63.25 \text{ or say } 64.$$

Reorder Level (ROL) $= \text{Safety stock} + \text{Lead time consumption}$

As the suggested model relates to A class items, there is no need for maintaining safety stock. But in this case, past lead time varies between 7 and 13 days and, therefore, safety stock will have to be maintained as under:

Past average lead time $(10 + 8 + 12 + 13 + 7) \div 5 = 10$ days

$$\text{Safety stock} = \frac{13 - 10}{2} \times 1,000 = 8 \text{ units}$$

$$ROL = 8 + \left(10 \text{ days} \times \frac{1,000}{360} \right) = 36 \text{ units}$$

$$\begin{aligned} \text{Maximum stock level} &= \text{Safety stock} + \text{EOQ} \\ &= 8 + 64 = 72 \text{ units} \end{aligned}$$

$$\begin{aligned} \text{Average stock level} &= (\text{Maximum stock} + \text{Minimum stock}) \div 2 \\ &= (72 + 8) \div 2 = 40 \text{ units.} \end{aligned}$$

Annual Inventory Cost and Savings due to EOQ

Problem 1.4. Anil Company buys its annual requirement of 36,000 units in 6 instalments. Each unit costs Re. 1 and the ordering cost is Rs. 25. The inventory carrying cost is estimated at 20% of unit value. Find the total annual cost of the existing inventory policy. How much money can be saved by Economic Order Quantity?

(C.A. Final, May 1986)

Solution.

	Rs.
(a) Ordering cost (6 orders @ Rs. 25)	150
Carrying cost of average inventory	
36,000 ÷ 6 = 6,000 units per order	
Average inventory = 3,000 units	
Carrying cost = 20% of Re. 1 or Re. 0.20	
= 3,000 × 0.20	600
Total Cost	750

$$(ii) \quad EOQ = \sqrt{\frac{2 \times 36,000 \times 25}{\text{Re. 1} \times 20\%}} \text{ or } 3,000 \text{ units}$$

No. of Orders = 36,000 ÷ 3,000 = 12 orders	Rs.
Ordering cost (12 × Rs. 25)	300
Carrying cost of average inventory	
(3,000 × 0.20) ÷ 2	300
Total Cost	600
Savings due to EOQ	150

Note : As the unit purchase cost of Re. 1 does not change in both the computations, the same has not been considered to arrive at total cost of inventory for the purpose of savings.

Problem 1.5, (Reorder-Levels). Shriram Enterprises manufactures a special product "ZED". The following particulars were collected for the year

- (a) Monthly demand of ZED—1,000 units.
 (b) Cost of placing an order Rs. 100.

- (c) Annual carrying cost per unit Rs. 15.
- (d) Normal usage 50 unit per week.
- (e) Minimum usage 25 units per week.
- (f) Maximum usage 75 units per week.
- (g) Re-order period 4 to 6 weeks.

Compute from the above

- (1) Re-order Quantity ; (2) Re-order Level
- (3) Minimum Level; (4) Maximum Levels
- (5) Average Stock Level.

(C.A. Inter, November 1987)

Solution.

$$(1) \text{ Re-order quantity } \sqrt{\frac{2AB}{C}}$$

where, A = Annual consumption

B = Buying cost per order

C = Annual carrying cost per unit

$$= \sqrt{\frac{2 \times 2,600^* \times \text{Rs. } 100}{\text{Rs. } 15}}$$

= 186 units (Approximately)

$$2. \text{ Re-order Level} = \text{Maximum Re-order period} \times \text{Maximum Usage} \\ = 6 \text{ weeks} \times 75 \text{ units} = 450 \text{ units}$$

$$3. \text{ Minimum Level}$$

$$= \text{Re-order level} - (\text{Normal Usage per period} \times \text{Average Delivery time}) \\ = 450 \text{ units} - (50 \text{ units} \times 5 \text{ weeks}) = 200 \text{ units}$$

$$4. \text{ Maximum Level} = \text{Re-order level} + \text{Re-order quantity} - \text{Minimum consumption during the period required to obtain delivery}$$

$$= 450 \text{ units} + 186 \text{ units} - 25 \text{ units} \times 4 \text{ weeks} \\ = 536 \text{ units.}$$

$$5. \text{ Average Stock Level}$$

$$= \frac{\text{Maximum level} + \text{Minimum level}}{2}$$

$$= (536 \text{ units} + 200 \text{ units}) \div 2 = 368 \text{ units}$$

$$^* \text{Annual Consumption} = 52 \text{ weeks} \times \text{Normal Usage per week} \\ = 52 \times 50 = 2,600 \text{ units.}$$

EOQ and Levels of Stock Holding

Problem 1.7. (i) A manufacturer uses 200 units of a component every month and he buys them entirely from an outside supplier. The order placing and receiving cost is Rs. 100 and annual carrying cost is Rs. 12. From this set of data, calculate the Economic Order Quantity.

(ii) P Ltd. uses three types of materials A, B and C for production of 'X', the final product. The relevant monthly data for the compo-

	A	B	C
Normal usage (units)	200	150	180
Minimum usage	100	100	90
Maximum usage	300	250	270
Reorder quantity	750	900	720
Reorder period (months)	2 to 3	3 to 4	2 to 3

Calculate from each component :

- (a) Reorder level ; (b) Minimum level ;
 (c) Maximum level ; and (d) Average stock level.

(I.C.W.A. Inter., June 1984, I.C.W.A., Inter., June 1986—Similar)

Solution. (i) $EOQ = \sqrt{\frac{2ab}{CS}}$

where q = annual consumption (200×12)

b = buying cost per order (Rs. 100)

C = Cost per unit (Not required as total carrying cost is given)

S = storage and carrying cost (Rs. 12)

Economic Order Quantity = $\sqrt{\frac{2 \times 200 \times 12 \times 100}{12}}$
 = 200 units.

- (ii) (a) Reorder level = Maximum reorder period \times Maximum usage

A	B	C
3×300	4×250	3×270
= 900 units	= 1,000 units	810 units

- (b) Minimum level = Reorder level \div (Normal usage
 Avg. delivery time)

A	B	C
$= 900 \div (200 \times 2.5)$	$1,000 \div (150 \times 3.5)$	$810 \div (180 \times 2.5)$
= 400 units	475 units	360 units.

- (c) Maximum level = Reorder level + Reordering quantity (Max. consumption \times Min. Reorder period)

A	B	C
$900 + 750 - (100 \times 2)$	$1,000 + 900 - (100 \times 3)$	$810 + 720 - (90 \times 2)$
= 1,450 units	= 1,600 units	= 1,350 units.

- (d) Average stock level = $\frac{\text{Maximum level} + \text{Min. level}}{2}$

A	B	C
$= \frac{400 + 1,450}{2}$	$= \frac{1,600 + 475}{2}$	$= \frac{1,350 + 360}{2}$
= 925 units	= 1038 units	= 855 units.

Optimum Ordering Quantity

Problem 1-8. From the following particulars with respect to a particular item of materials of a manufacturing company, calculate the best quantity to order :

Ordering quantities(Tonnes)	Price per Tonne
Less than 250	Rs. 6'00
250 but less than 800	5'90
800 but less than 2,000	5'80
2,000 but less than 4,000	5'70
4,000 and above	5'60

The annual demand for the material is 4,000 tonnes.

Stock holding costs are 20% of material cost p.a.

The delivery cost per order is Rs. 6'00. (I.C.M.A., Adapted)

Solution,

**Statement Showing the Optimum
Ordering Quantity of Materials**

1. Order size (tonnes)	200	250	800	2,000	4,000
2. No of orders (Annual demand ÷ Order size)	20	16	5	2	1
3. Value per order (Order size × Price per tonne)	Rs. 1,200	1,475	4,640	11,400	22,400
4. Average inventory (Value per order ÷ 2)	Rs. 600	738	2,320	5,700	11,200
Ordering cost (No. of orders × Ordering cost per order)	Rs. 120	96	30	12	6
Carrying cost (20% of item 4)	120	148	464	1,140	2,240
Total	240	244	494	1,152	2,246
Annual cost of material (Annual demand × Price)	24,000	23,600	23,200	22,800	22,400
Total annual cost	24,240	23,844	23,694	23,952	24,646

Rs. 23,694 is the total minimum cost at 800 order size. Therefore, the best quantity to be ordered is 800 tonnes.

Economic Lot Size and Re-order Point

Problem 1-9 The daily demand for an electronic machine is approximately 25 items. Every time an order is placed, a fixed cost of

Rs. 25 is incurred. The daily holding cost per item inventory is Re. 0.40. If the lead time is 16 days, determine the economic lot size and the reorder point. [I.C.W.A. Final (R.S.), Dec. 1985]

Solution: $EOQ = \sqrt{\frac{2ab}{CS}}$

where a = Annual consumption b = Buying cost per order;
 C = Cost per unit ; S = Storage and carrying cost rate (N.A.)

$$= \sqrt{\frac{2 \times 25 \times 365 \times 25}{0.40 \times 365}} = 56$$

$$\begin{aligned} \text{Re-order point} &= \text{Safety stock} + (\text{Lead time} \times \text{Avg. daily usage}) \\ &\quad (\text{Not given}) \\ &= 16 \times 25 = 400 \text{ items} \end{aligned}$$

Note : In this problem, safety stock is not given and, therefore, 400 items will be treated as re-order point.

EOQ and Total annual inventory cost

Problem 1'10. Following information relating to a type of raw material is available :

Annual Demand	2,400 units
Unit Price	Rs. 2.40
Ordering cost per order	Rs. 4.00
Storage cost	2% per annum
Interest rate	10% per annum
Lead time	Half month

Calculate Economic Order quantity, and total annual inventory cost in respect of the particular raw material. (I C W.A. Inter, June 1988)

Solution : Economic Order Size

$$\begin{aligned} &= \sqrt{\frac{2ab}{cs}} = \sqrt{\frac{2 \times \text{Annual Consumption} \times \text{Buying cost per order}}{\text{Cost per unit} \times \text{Storage and carrying cost rate}}} \\ &= \sqrt{\frac{2 \times 2400 \times 4}{2.40 \times 12\%}} = \sqrt{\frac{19,200}{0.288}} = 258 \text{ units} \end{aligned}$$

Total annual inventory cost.

No of orders = $2400 \text{ units} \div 258 = 9.3$ orders or say 10 orders

(i) Ordering Cost = $10 \text{ orders} \times \text{Rs. 4}$ = Rs. 40.00

(ii) Carrying Cost of Average inventory

$\frac{1}{2}$ (No of Units in an order) $\times cs$

or $\frac{1}{2} (258) \times \{2.40 \times 12\%\}$ = 37.15

$$(iii) \text{ Purchase Cost, i.e., } 2400 \text{ units} \times \text{Rs. } 2.40 = 5,760.00$$

$$5,837.15$$

EOQ, and Optimum Period of Supply

Problem 1·11. A manufacturer has to supply his customer 600 units of his product per year. Storage is not allowed and the inventory carrying cost amount to Re. 0·60 per unit per year. The set-up cost per run is Rs. 80. Find :

- The Economic order quantity.
 - The minimum average yearly cost.
 - The optimum number of orders per year.
 - The optimum period of supply per optimum order.
- [I.C.W.A. Final (R.S.), June 1985]

Solution. (i) $EOQ = \sqrt{\frac{2ab}{CS}} = \sqrt{\frac{2 \times 600 \times 80}{0.60}}$ or 400 units

(ii) No. of orders placed $= 600 \div 400 = 1\frac{1}{2}$ orders or say 2 orders

Rs.
160

Set up cost for 2 orders @ Rs. 80

Average inventory cost per year $(400 \times 0.60) \div 2 = 120$

280

Minimum average yearly cost

(iii) Optimum number of orders per year $= 600 \div 400$
 $= 1\frac{1}{2}$ or say 2 orders

(iv) Optimum period of supply per optimum order.

For 600 units optimum period $= 12$ months

For 400 units „ „ „ $= (12 \div 600) \times 400 = 8$ months.

EOQ with Discount on different order sizes

Problem 1·12. A company's monthly requirement of an inventory item is 1,800 units. The cost of processing an order is Rs. 5 and the carrying cost per unit is 20 Paise. The company's supplier agrees to offer quantity discounts as under :

Lot Size (in Units)	Up to				above
Discount (in Rs.)	400	401—600	601—800	801—1,000	1,000
	Nil	6	10	15	20

Lead time is 2 days and the company wishes to keep a safety stock equal to 50% of the usage in the lead time.

- Find the Economic Ordering Quantity (EOQ) without considering the offer of discount.
- Calculate reorder point taking 30 working days in a month.

- (c) Tabulate different types of cost as also effect of discount on different order sizes taking 1, 2, 3,, 7 orders a month and indicate the E.O.Q. (C.A. Final, Nov. 1985)

Solution. (a) $EOQ = \sqrt{\frac{2ab}{CS}}$

$a = 1800 \times 12 = 21,600$; $b = \text{Rs. } 5$; $CS = 0.20$ (Given)

$EOQ = \sqrt{\frac{2 \times 21,600 \times 5}{0.20}} = 1039 \text{ units}$

or say 1000 units.

- (b) Reordering Point = Safety Stock + Lead time consumption

Safety Stock = 50% of $(1800 \div 30) \times 2 = 60$ units

Reordering Point = $60 + 2 \times 60 = 180$ units

- (c) *EOQ with discount on different order sizes*

Order size	1800	900	600	450	360	300	257
No. of orders	1	2	3	4	5	6	7
Average inventory	900	450	300	225	180	150	129
Ordering cost (Rs.)	5	10	15	20	25	30	35
Carrying cost of avg. inventory @ Re 0.20	180	90	60	45	36	30	26
Total cost	185	100	75	65	61	60	61
Less discount	20	15	6	6	—	—	—
Net cost	165	85	69	59	61	60	61

EOQ is 450 units at which net cost is the lowest among different order sizes.

EOQ and Frequency of Orders

Problem 1.13. A wholesaler supplies 30 stuffed dolls each week day to various shops. Dolls are purchased from the manufacturer in lots of 120 each of Rs. 1200 per lot. Every order incurs a handling charge of Rs. 60 plus a freight charge of Rs. 2.50 per lot. Multiple and fractional lots also can be ordered and all orders are filled the next day. The incremental cost is Re. 0.60 per year to store a doll in inventory. The wholesaler finances inventory investment by paying its holding company 2% monthly for borrowed funds.

(i) How much dolls should be ordered at a time in order to minimise the total annual inventory cost? Assume that there are 250 week days in a year. How frequently should he order?

[I.C.W.A. Final (R.S.), Dec. 1984]

Solution : (i) First of all, it is necessary to find out the (a) Annual consumption/demand (b) Buying cost per order and (c) Carrying cost per annum.

$$(a) = 30 \text{ dolls} \times 250 \text{ weekdays} = 7500 \text{ Dolls}$$

$$(b) = \text{Rs. } 60 \text{ (handling charge)} + \text{Rs. } 250 \text{ (freight)} = \text{Rs. } 310$$

$$C) = \text{Rs. } 1200 \div 120 = \text{Rs. } 10 \times 2\% \text{ p.m. or } 24\% \text{ p.a.} + 0.60 = \text{Rs. } 3$$

$$\text{EOQ} = \sqrt{\frac{2 \times 7,500 \times 310}{3}} = 1,245 \text{ dolls.}$$

(ii) 7,500 dolls to be ordered in 12 months

$$1,245 \text{ dolls} \quad ,, \quad ,, \quad (12 \div 7,500) \times 1,245 = 2 \text{ months} \\ \text{or 6 orders per annum.}$$

VALUATION OF MATERIALS

FIFO and LIFO Methods

Problem 114. From the records of an oil distributing company, the following summarised information is available for the month of March 1986:

Sales for the month : Rs. 19,25,000

Opening Stock as on 1-3-86 : 1,25,000 litres @ Rs. 6.50/litre.

Purchases (including freight and insurance) :

March 5 150,000 litres @ Rs. 7.10/litre

March 27 100,000 litres @ Rs. 7.00/litre

Closing stock as on 31-3-86 : 130,000 litres

General Administration expenses for the month : Rs. 45,000.

On the basis of the above information, work out the following using FIFO and LIFO methods of inventory valuation assuming pricing of issues is being done at the end of the month after all receipts during the month :

(a) Value of closing stock as on 31-3-86

(b) Cost of goods sold during March '86

(c) Profit or loss for March '86.

(I.C.W.A. Inter, June 1987 ; Similar to C.A. Inter, May 1977)

Solution. (a) Valuation of closing stock as on 31-3-1986 :

(i) **FIFO Method.** (The closing stock will comprise the items purchased in the end)

1,00,000 litres purchased on 27-3-86 @ Rs. 7.00 Rs. 7,00,000

30,000 litres from purchases made on 5-3-86 @ Rs. 7.10 2,13,000

1,30,000 Value of closing stock under FIFO method 9,13,000

(ii) **LIFO Method.** (The closing stock will comprise the items in opening stock and purchased in the beginning)

	Rs.
1,25,000 litres from opening stock @ Rs. 6.50	8,12,500
5,000 litres from purchases made on 5-3-86 @ Rs. 7.10	35,500
<hr/>	<hr/>
1,30,000 Value of closing stock under LIFO method	8,48,000
== =	== =

<i>(b) Cost of Goods Sold</i>	<i>FIFO Method</i>	<i>LIFO Method</i>
Opening stock as on 1-3-1986	Rs. 8,12,500	Rs. 8,12,500
Purchases made on 5th March	10,65,000	10,65,000
Purchases made on 27th March	7,00,000	7,00,000
<hr/>	<hr/>	<hr/>
Total	25,77,500	25,77,500
Less Closing stock as per (a)	9,13,000	8,48,000
<hr/>	<hr/>	<hr/>
Cost of material consumed	16,64,500	17,29,500
Add General Adm. Expenses	45,000	45,000
<hr/>	<hr/>	<hr/>
Cost of goods sold	17,09,500	17,74,500
	== =	== =

<i>(c) Profits</i>	<i>FIFO Method</i>	<i>LIFO Method</i>
Cost of goods sold	Rs. 17,09,500	Rs. 17,74,500
Sales	19,25,000	19,25,000
<hr/>	<hr/>	<hr/>
Profit	2,15,500	1,50,500
	== =	== =

LIFO Method during Rising Prices

Problem 1.15. (a) What are the factors to be considered for fixing up various levels of maintaining stock of materials ?

(b) The following are the transactions in respect of purchase and issue of components forming part of an assembly of a product manufactured by a firm which requires to update its cost of production, very often for bidding tenders and finalising cost plus contracts.

<i>Date</i>	<i>Quantity (in Nos.)</i>	<i>Particulars</i>
1986—January 5	1000	purchased at Rs. 1.20 each
11	2000	issued
February 1	1500	purchased at Rs. 1.30 each
18	2400	issued
26	1000	issued
March 8	1000	purchased at Rs. 1.40 each
17	1500	purchased at Rs. 1.30 each
28	2000	issued

The stock on January 1, 1986 was 5,000 Nos. valued at Rs. 1'10 each. State the method you would adopt in pricing the issue of components giving reasons. What value would you place on stocks as on March 31 which happens to be the financial year-end and how would you treat the difference in value, if any, on the stock account?

(I.C.W.A. Inter., Dec. 1986)

Solution. For part (a), refer to *Advanced Cost and Management Accounting—Text* by Saxena & Vashist.

(b) In order to find out the value of stocks as on 31st March, it is necessary to prepare the stock ledger based on the information given in the question. It is noticed that the purchase price of component is going up month by month. Therefore, during rising prices, it is better to adopt LIFO method of pricing issues. Stock Ledger is given on page P1'14.

FIFO, LIFO and Weighted Average Method

Problem 1'16. You are presented with the following information by Om Engineering Company relating to the first week of December, 1986 :

(a) Materials—The transactions in connection with the materials are as follows :

Days	Units	Receipts Rate per unit (Rs.)	Issues (Units)
1st	40	15'00	—
2nd	20	16'50	—
3rd	—	—	30
4th	50	17'10	—
5th	—	—	20
6th	—	—	40

Calculate the cost of materials issued under FIFO method, LIFO method and weighted average method of issue of materials and value of closing stock under the methods aforesaid and discuss from different points of view which methods you would prefer.

Halsey and Rowan Methods of Wage Payment

(b) Labour—The firm employs five workers at an hourly rate of Rs. 2'00. During the week they worked for four days for a total period of 40 hours each and completed a job for which the standard time was 48 hours for each worker. Calculate the labour cost under the Halsey method and Rowan method of incentive plan payments.

(c) Compute the prime cost of the job completed under different methods of valuing material issues and calculation of labour costs.

(C.S. Inter., Dec. 1986)
(Solution on page P1'15)

(From page P1-12)

Solution.

(a) **Ori Engineering Company**

Materials receipts			FIFO Method			LIFO Method			Weighted Average Method		
Days	Units	Rate	Units	Rate	Amount	Units	Rate	Amount	Units	Rate	Amount
1st	40	15									
2nd	20	16.50									
3rd	—	—	30	15	450	20	16.50	330	30	15.50	465
4th	50	17.10				10	15.00	150			
5th			10	15	150						
			10	16.50	165	20	17.10	342	20	16.50*	330
6th			10	16.50	165						
			30	17.10	513	30	17.10	513	40	16.50	660
Total	110	1785	90		1443	10	15.00	150	90		1455
Balance			20	17.10	342	20	15	300	20	16.50	330

* $(30 \times 15.50 + 50 \times 17.10) \div 80$ Rs. 16.55.

There is a constant rise in prices. If FIFO method is followed, cost of material charged to job will be minimum. Cost of material charged to job will be maximum under LIFO method. The effect of rise in prices is averaged out in weighted average method. From valuation point of view, value of closing stock will be maximum under FIFO method, minimum under LIFO method and moderate under weighted average method. From managerial control point of view, weighted average method will be better than other two methods.

- (b) Hours worked = 200 hours
 Standard hours = 240 hours
 Time Saved = 40 hours
 Time Rate = Rs. 2 per hour

Total wages under Halsey Method

$$= \text{Time taken} \times \text{Time rate} + \frac{1}{2} (\text{Time saved} \times \text{Time rate})$$

$$= 200 \times 2 + \frac{1}{2} (40 \times 2) = \text{Rs. 440}$$

Total wages under Rowan Method

$$= \text{Hours worked} \times \text{Time rate}$$

$$+ \left\{ \frac{\text{Time saved}}{\text{Time allowed}} \times \text{Hours worked} \times \text{Rate per hour} \right\}$$

$$= 200 \text{ hrs.} \times \text{Rs. 2} + \left(\frac{40 \text{ hrs}}{240 \text{ hrs}} \times 200 \text{ hrs} \times \text{Rs. 2} \right) = \text{Rs. 467.}$$

- (c) **Statement showing prime cost under different methods of valuing materials issues and labour payments.**

	FIFO		LIFO		Weighted Average	
	Halsey	Rowan	Halsey	Rowan	Halsey	Rowan
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Material cost	1,443	1,443	1,485	1,485	1,455	1,455
Labour cost	440	467	440	467	440	467
Prime cost	1,883	1,910	1,925	1,952	1,895	1,922

Computation of Value of Inventory

Problem 1:17. The Directors of Quality Machineries Ltd., request you to ascertain the amount at which the inventory should be included in the financial statement for the year 1978-79. The value of inventory as shown in the books is Rs. 12,50,000.

To determine the net realisable value of the inventory (on a test check basis), you had selected several items whose book value was Rs. 3,50,000. You ascertain that except for items (i) to (iii) mentioned below, the cost was in excess of the realisable value by Rs. 29,532.

The following items require special treatment :

- (i) One machine (cost Rs. 1,30,000) can now fetch Rs. 1,15,000. It was priced at Rs. 70,000 and was written down to the same figure at the end of 1978-79.
- (ii) A pump (cost Rs. 50,000) was expected to realise Rs. 35,000. A special commission would have to be paid to the broker.
- (iii) 6 units of product No. 15,710 were in stock valued each at Rs. 5,520 ; the selling price was Rs. 4,800 per unit ; selling expenses are 10% of the selling price.

Taking into consideration only the above-mentioned items requiring special treatment, compute the value of their inventory as at 31st March, 1979 you would consider reasonable. (C.A. Final, Nov. 1979)

Suggested Approach

Book value of selected items is given. From the given information, realisable value of remaining selected items will have to be found. Then the value of inventory (at net realisable value) for all the items to be included in the financial statements of the company for the year 1978-79 is to be worked out.

Solution : Workings showing Realisable Value of Selected Items

Book value of selected items		Rs. 3,50,000
Less : Book value of items (i) to (iii) :		
(i) One machine	Rs. 70,000	
(ii) One pump	50,000	
(iii) 6 units of product No. 15,710		
@ Rs. 5,520	33,120	
		<u>1,53,120</u>
Remaining book value		<u>1,96,880</u>

It is given in the question that except for the items (i) to (iii), the cost was in excess of realisable value by Rs. 29,532.

In order to find out the realisable value of remaining items, this amount should be deducted from the book value of selected items.

∴ the realisable value of remaining selected items will be

$$\text{Rs. } 1,96,880 - \text{Rs. } 29,532 = \text{Rs. } 1,67,348$$

Percentage of the cost in excess of realisable value to the book value of selected items

$$= \frac{29,532}{1,96,880} \times 100 = 15\%$$

**Workings showing the Inventory Valuation
(on Net Realisable Value Basis)**

as on 31-3-1979

	Rs.
Value of all the items as shown in the books	12,50,000
Less : Book value of special items	3,50,000
Book value of the remaining items	9,00,000
Less : Cost of excess of realisable value by 15% (9,00,000 × 15%)	1,35,000
	7,65,000
Add : Realisable value of remaining selected items	1,67,348
	9,32,348

Add : Realisable value of selected items :

(i) One machine	Rs. 1,15,000	
(ii) One pump (Rs. 35,000 less 15% brokerage)	29,750	
(iii) 6 units of product No. 15,710 (6 × 4,500 less 10% selling expenses)	24,300	
		1,69,050
Value of all items of inventory (as on 31-3-79)		11,01,398

Cost of Material Purchased and Issued to Production

Problem 118. The particulars relating to 1200 kg. of a certain raw material purchased by a company during June, were as follows :

(a) Lot prices quoted by supplier and accepted by the company for placing the purchase order :

Lot upto 1,000 kg.	@ Rs. 22/- per kg.	} F.O.R. Supplier's Factory.
Between 1,000-1500 kg.	@ Rs. 20/- " "	
Between 1,500-2000 kg.	@ Rs. 18/- " "	

(b) Trade discount 20%.

- (c) Additional charge for containers @ Rs. 10 per drum of 25 kg.
- (d) Credit allowed on return of containers @ Rs. 8 per drum.
- (e) Sales Tax at 10% on raw material and 5% on drums.
- (f) Total freight paid by the purchaser Rs. 240.
- (g) Insurance at 2.5% (on Net Invoice Value) paid by the purchaser.
- (h) Stores overhead applied at 5% on total purchase cost of material.

The entire quantity was received and issued to production. The containers are returned in due course. Draw up a suitable statement to show : (a) Total cost of material purchased ; and

- (b) Unit cost of material issued to production.

(I.C.W.A. Inter, Dec. 1985)

Solution.

	Amount	Cost per unit
	Rs.	Rs.
Raw materials (1200 kgs. × Rs. 20)	24,000.00	20.00
Less : Trade Discount @ 20%	4,800.00	4.00
	<hr/> 1,9200.00	<hr/> 16.00
Add Charge for containers : (1200 × 10/25)	480.00	0.40
	<hr/> 19,680.00	<hr/> 16.40
Sales Tax :		
10% on Rs. 19,200 (raw materials)	1920.00	1.60
5% on Rs. 480 (drums)	24.00	0.02
	<hr/> 21,624.00	<hr/> 18.02
Net Invoice value	21,624.00	18.02
Freight paid	240.00	0.20
Insurance at 2.5% on Rs. 21,624	540.60	0.45
	<hr/> 22,404.60	<hr/> 18.67
Less : Credit for containers (48 × Rs. 8)	384.00	0.32
	<hr/> 22,020.60	<hr/> 18.35
Stores overhead applied (5% on total purchase cost)	1,101.03	0.92
	<hr/> 23,121.63	<hr/> 19.27
	<hr/> <hr/>	<hr/> <hr/>

(i) Total cost of raw material issued to production Rs. 23,121.63

(ii) Unit cost of material issued to production Rs. 19.27

Total cost of imported material

Problem 1.19. The particulars relating to the import of Sealing Ring made by AB & Co., during December, 1985 are given below :

(a) Sealing Ring—1,000 pieces invoiced @ £ 2.00 C.I.F., Bombay Port.

(b) Customs duty was paid @ 100% on Invoice Value (which was converted to Indian currency by adopting an exchange rate of Rs. 17.20 per £).

(c) Clearing charges—Rs. 1,800 for the entire consignment, and

(d) Freight charges—Rs. 1,400 for transporting the consignment from Bombay Port to factory premises.

It was found on inspection that 100 pieces of the above material were broken and, therefore, rejected. There is no scrap value for the rejected part. No refund for the broken material would be admissible as per the terms of contract. The Management decided to treat 60 pieces as normal loss and the rest 40 pieces as abnormal loss. The entire quantity of 900 pieces was issued to production.

Calculate :

(a) Total cost of material, and

(b) Unit cost of material issued to production.

Also state briefly how the value of 100 pieces rejected in inspection will be treated in costs. (I.C.W.A. Inter, June 1986)

Solution.

AB & Co.

(a) *Computation of total cost of materials*

	Rs.
Sealing rings (1000 × 2 × 17.20)	34,400
Customs duty 100% of Invoice value	34,400
Clearing charges at port	1,800
Freight charges—Port to factory	1,400
Total Cost of materials	72,000

(b) *Unit cost of material*

Total quantity received	Nos. 1,000
Less : Normal loss	60
	<hr/>
Less : Abnormal loss	940
	40
	<hr/>
Total pieces issued to production	900

MATERIALS**P121**

Total cost of materials	Rs. 72,000
This is to be spread over 940 units.	
Unit cost of material issued to production (Rs. 72,000 ÷ 940)	Rs. 76.5957

Note. The cost of normal loss is to be borne by production during the period and abnormal loss is treated like good units produced for the purpose of valuation:-

Cost to be charged to production (900 units × Rs. 76.5957)	Rs. 68,936
Cost to be charged off to P & L A/c (40 units × Rs. 76.5957)	3,064
	<u>72,000</u>

Different Methods of Material Issues

Problem 120. From the following transactions extracted from the books of accounts of a manufacturing concern as on 31st December 1980, work out (a) Consumption value of raw materials in the month and (b) Value of closing stock as on 31st December, 1980, under the following four methods of pricing issues :

- (i) FIFO. (ii) LIFO. (iii) Moving Average Cost.
(iv) Weighted Average Cost (end of month).

Show the results in a tabular form.

			Quantity in units	Rate per unit Rs.
1980 December	1	Opening Stock	300	9.70
	3	Purchases	250	9.80
	11	Issues	400	
	15	Purchases	300	10.05
	20	Issues	210	
	25	Purchases	150	10.30
	29	Issues	100	

(I.C.W.A. inter. June 1981)

(ii) LIFO Method

Date	Particulars	Receipts			Issues			Balance		
		Unit	Rate	Value	Unit	Rate	Value	Unit	Rate	Value
			Rs.	Rs.		Rs.	Rs.		Rs.	Rs.
Dec, 1980										
1	Opening stock							300	9.70	2,910.00
3	Purchases	250	9.80	2,450				300	9.70	2,910.00
								250	9.80	2,450.00
11	Issues	—	—	—	250	9.80	2,450	550		5,360.00
					150	9.70	1,455	150	9.70	1,455.00
15	Purchases	300	10.05	3,015	400		3,905			
					—	—	—	150	9.70	1,455.00
								300	10.05	3,015.00
20	Issues	—	—	—	210	10.05	2,110.50	450		4,470.00
								150	9.70	1,455.00
								90	10.05	904.50
25	Purchases	150	10.30	1,545	—	—	—	240		2,359.50
								150	9.70	1,455.00
								90	10.05	904.50
								150	10.30	1,545.00
29	Issues				100	10.30	1,030.00	390		3,904.50
								150	9.70	1,455.00
								90	10.05	904.50
								50	10.30	515.00
		700		7,010	710		7,045.50	290		2,874.50

A. FIFO Method

(a) Value of Closing Stock 290 units : 140 units @ Rs. 10.05 per unit
150 units @ Rs. 10.30 per unit

Rs.
1,407
1,545

2,952

(b) Value of Consumption
Op. Stock 300 units @ Rs. 9.70 per unit = Rs. 2,910

Add : Receipts

250 units = Rs. 2,450.00
300 units = Rs. 3,015.00
150 units = Rs. 1,545.00

700
Total (300+700) = 7,010
Less : Closing Stock 1,000 units = 9,920
290 units = 2,952

Value of Issues to Production 710 = 6,968

B. LIFO Method

(i) Value of Closing Stock 150 units @ Rs. 9.70 per unit
90 units @ Rs. 10.05 per unit
50 units @ Rs. 10.30 per unit

Rs.
1,455.00
904.50
515.00

2,874.50

290

(ii) Value of Consumption :

Opening Stock 300 units @ Rs. 9.70 = Rs. 2,910.00
Receipts 700 units as per
(b) above under FIFO = 7,010.00

Total 1,000 units 9,920.00
Less : Closing Stock 290 units as per (i) above = 2,874.50

Value of Issues to Production 710 units = 7,045.50

(iii) Moving Average Method (Weighted)

Date	Particulars	Receipts			Issues			Balance			Remarks
		Unit	Rate	Value	Unit	Rate	Value	Unit	Rate	Value	
Dec. 1980			Rs.	Rs.		Rs.	Rs.		Rs.	Rs.	
1	Opening Stock							300	9.70	2,910.00	(a) Average Rate per unit Rs. 9.75
3	Purchases	250	9.80	2,450	—	—	—	250	9.80	2,450.00	(b) Average Rate per unit Rs. 9.94 (approx.)
11	Issues	—	—	—	400	9.75	3,900.00	550		5,360.00 (a)	(c) Average Rate per unit Rs. 10.08 (approx.)
15	Purchases	300	10.05	3,015	—	—	—	300		1,460.00*	
										3,015.00	
20	Issues	—	—	—	210	9.94	2,087.40	450		4,475.00 (b)	
25	Purchases	150	10.30	1,545	—	—	—	240		2,387.60	
								150		1,545.00	
29	Issues	—	—	—	100	10.08	1,008	390		3,932.60 (c)	
								290		2,924.60	

(1) Value of Closing Stock of 290 units = Rs. 2,924.60 or Rs. 10.08 approx. per unit.

(2) Value of Consumption (Issues) of 710 units = Rs. 6,995.40

(i) 400 units @ Rs. 9.75 per unit

(ii) 210 units @ Rs. 9.94 per unit

(iii) 100 units @ Rs. 10.08 per unit

* Rs. 5,360 - Rs. 3,900 = Rs. 1,460.

(iv) Weighted Average Method (Periodic)

Date	Particulars	Receipts			Issues			Balance			Remarks
		Unit	Rate Rs.	Value Rs.	Unit	Rate Rs.	Value Rs.	Unit	Rate Rs.	Value Rs.	
Dec. 1980											
1	Opening Stock							300	9.70	2,910	
3	Purchases	250	9.80	2,450				250	9.80	2,450	
15	Purchases	300	10.05	3,015				300	10.05	3,015	
25	Purchases	150	10.30	1,545				150	10.30	1,545	
								1,000		9,920	(A) Average Rate per unit Rs. 9.92
										(A)	
11	Issues				400	9.92	3,968.00				All issues are priced at this rate.
20	Issues				210	9.92	2,083.20				
29	Issues				100	9.92	992.00	290		2,876.80*	
					710		7,043.20				

(a) Value of Consumption (Issues) of 710 units = Rs. 7,043.20.

(b) Value of Closing Stock 290 units = Rs. 2,876.80

*Rs. 9,920 - Rs. 7,043.20 = Rs. 2,876.80.

Valuation of Closing Stock

Problem 121. You are the Chief Accountant of a sugar factory, whose cost of production per tonne of sugar is given below :

<i>Year ended</i>	<i>30-6-1979</i>	<i>30-6-1980</i>
	<i>Rs.</i>	<i>Rs.</i>
Sugarcane cost	1,700	1,900
Sugarcane transport and supervision	50	55
Other process chemicals	45	50
Fuel	15	16
Salaries, wages and bonus	60	75
Repairs, renewals and maintenance	125	135
Packing materials and expenses	75	85
Interest	250	150
Selling overheads	20	20
Administration overheads	85	95
Depreciation	300	300
Total cost	2,725	2,881
Free Market sale price	2,800	4,800
Controlled market sale price	2,600	2,600
Export price	1,650	5,400

Salaries, wages and bonus include Administration salaries Rs. 20.

You have been valuing the closing stock of sugar consistently at cost or market price whichever is lower. For the purpose of arriving at cost you have been taking the total cost as given above.

The auditor objects to the method of arriving at cost adopted in view of the International Accounting Standard No. 2 on valuation of inventory and he wants to exclude the depreciation, interest, administration and selling overheads.

Keeping the recommendations of the International Accounting Standard in view, give your opinion on :

- (1) What shall be the cost for the purpose of valuation of stock in both the above years ?
- (2) In view of the accumulation of heavy stock, the Directors want to be consistent with the method of valuation of stocks as in the past in order to present a reasonable financial position. Will you be able to convince the auditors that the method of arriving at total cost is the correct method and if yes, how ?
- (3) If the auditor's opinion is adopted, what shall be the nature of disclosure in the published accounts, if any ?

- (4) What shall be the basis for valuing stock in each of the above years ?

Note. Local sales price includes excise duty of Rs. 500 per tonne.

(I.C.W.A. Final, Dec. 1980)

:Solution.

(1) According to the International Accounting Standard No. 2, the closing stock of finished goods should be valued at the lower of historical cost and net realisable value. Then the cost of production per tonne and net realisable value of sugar for the two periods will be as under :

<i>Year ended</i>	<i>30-6-1979</i>	<i>30-6-1980</i>
Sugarcane cost	Rs. 1,700	Rs. 1,900
Sugarcane transport and supervision	50	55
Other process chemicals	45	50
Fuel	15	16
Salaries, wages and bonus excluding Administration salaries	40	55
Repairs, renewals and maintenance	125	135
Packing materials and expenses	75	85
Depreciation	300	300
Cost of production	2,350	2,596

*Net realisable value, i.e., after deducting
excise duty of Rs. 500 per tonne :*

Free market sale price	2,300	4,300
Controlled market sale price	2,100	2,100

Closing stock for both the years should be valued at net realisable value, i.e., Rs. 2,100 because it is less than the cost of production.

(2) It is not given in the question whether interest is paid on long-term borrowing or short-term borrowing. In the absence of this information, it is assumed that the interest is paid on short-term borrowing utilised for meeting working capital requirement. In view of this, cost of production includes depreciation, administration overheads and interest. Selling overheads do not form part of cost of production. Apparently, selling overheads are part and parcel of cost of sales. Therefore, the views expressed by auditor for exclusion of depreciation, administration and interest for valuation purposes are not correct. Hence, the closing stock should be valued at cost of production, i.e., total cost of sales less selling overheads. If the net realisable value is lower than the cost of production, closing stock should be valued at net realisable value.

(3) If the auditor's opinion is adopted for valuation of stock of finished goods, the following disclosure should be made in the published accounts :

- (a) That the company has deviated from the existing method of valuation of sugar stocks.
- (b) Consequential effect on the profit or loss should be calculated and disclosed in the form of a note in the Balance Sheet.
- (4) Basis of valuation of closing stock will be as under :

<i>For the year ending 30-6-79</i>	Rs.
Total cost less selling overheads (Rs. 2,725—Rs. 20)	2,705
Export price (lowest of all the realisable values)	1,650
The closing stock should be valued at Rs. 1,650 per tonne of sugar.	

For the year ending 30-6-80

Total cost less selling overheads	2,861
Controlled market sale price less excise duty	2,100

In this case, the valuation of closing stock of sugar should be at Rs. 2,100.

FIFO, LIFO and Weighted Average Methods of Issues

Problem 122. The following information is extracted from the Stores Ledger :

Material X	
Opening Stock	Nil
Purchases :	
Jan. 1	50 @ Rs. 1 per unit
Jan. 20	100 @ Rs. 2 per unit
Issues :	
Jan. 22	60 for Job W-16
Jan. 23	60 for Job W-17

Complete the receipts and issues valuation by adopting the First In First Out, Last In First Out and the Weighted Average Method. Tabulate the values allocated to Job W-16, Job W-17 and the closing stock under the methods aforesaid and discuss from different points of view which method you would prefer.

(C.A. Inter, Nov. 1985)

Solution. Statement showing receipts and issues adopting First-in-First-Out Method

Date	Particulars	Receipts			Issues			Balance		
		Unit	Rate	Value	Unit	Rate	Value	Unit	Rate	Value
Jan. 1	Purchases	No. 100	Rs. 1	100.00	No.	Rs.	Rs.	No.	Rs.	Rs.
20	Purchases	100	2	200.00				100	1	100
								100	1	100
								100	2	200
22	Issues to Job W-16				60	1	60	40	1	40
								100	2	200
23	Issues to Job W-17				40	1	40			
					20	2	40	80	2	160

Statement showing receipts and issues adopting Last in-First Out Method

Date	Particulars	Receipts			Issues			Balance		
		Unit	Rate	Value	Unit	Rate	Value	Unit	Rate	Value
Jan. 1	Purchases	No. 100	Rs. 1	100	No.	Rs.	Rs.	No.	Rs.	Rs.
20	Purchases	100	2	200				100	1	100
								100	1	100
								100	2	200
22	Issues to Job W-16				60	2	120	100	1	100
								40	2	80
23	Issues to Job W-17				40	2	80			
					20	1	20	80	1	80

Statement of receipts and issues adopting Weighted Average Method

Date	Particulars	Receipts			Issues			Balance		
		Unit	Rate	Value	Unit	Rate	Value	Unit	Rate	Value
Jan. 1	Purchases	No. 100	Rs. 1	Rs. 100	No.	Rs.	Rs.	No.	Rs.	Rs.
20	Purchases	100	2	200				100	1	100
22	Issues to job W-16							200	1.5	300
23	Issues to job W-17				60	1.5	90	140	1.5	210
					60	1.5	90	80	1.5	120

Statement showing the values allocated to Job W-16, Job W-17 and closing stock under the aforesaid methods

	FIFO		LIFO		Average	
	Rs.		Rs.		Rs.	
Material for job W-16	60		120		90	
Material for job W-17	80		100		90	
Closing Stock	160		80		120	

Comments :

1. In period of rising prices, FIFO method leads to rise in prices and use of LIFO method leads to low profits. In case of weighted average method, there is no significant adverse or favourable effect on cost of material or on profit.
2. Value of stock is maximum under FIFO, moderate under weighted average and minimum under LIFO method.
3. Weighted average Method smoothenes the fluctuations in prices.

Weighted average method should be preferred over LIFO and FIFO methods.

Weighted Average Method

Problem 123. From the following details of stores receipts and issues of material "EXE" in a manufacturing unit, prepare the Store Ledger using Weighted Average method of valuing the issues.

- Nov. 1. Opening stock 2,000 units @ Rs. 5'00 each
- „ 3. Issued 1,500 units to production
- „ 4. Received 4,500 units @ Rs. 6'00 each
- „ 8. Issued 1,600 units to production
- „ 9. Returned to stores 100 units by Production Department (from the issues of Nov. 3)
- „ 16. Received 2,400 units @ Rs. 6'50 each
- „ 19. Returned to supplier 200 units out of the quantity received on Nov. 4
- „ 20. Received 1,000 units @ Rs. 7'00 each
- „ 24. Issued to production 2,100 units
- „ 27. Received 1,200 units @ Rs 7'50 each
- „ 29. Issued to production 2,800 units.

(Use rates up to two decimal places).

(I.C.W.A. Inter June 1988, Dec. 1985)

Solution. **Store Ledger (Weighted Average Method)**

Date	Receipts			Issues			Balance		
	Qty.	Rate	Amount	Qty.	Rate	Amount	Qty.	Rate	Amount
Nov									
1									
3				1,500	5.00	7,500	2,000	5.00	10,000
4	4,500	6.00	27,000				500	5.00	2,500
8				1,600	5.90	9,440	5,000	5.90	29,500
9	100	5.00	500				3,400	5.90	20,060
16	2,400	6.50	15,600				3,500	5.87	20,560
19				200	6.00*	1,200	5,900	6.13	36,160
26	1,000	7.00	7,000				5,700	6.13	34,960
24				2,100	6.26	13,146	6,700	6.26	41,960
27	1,200	7.50	9,000				4,600	6.26	28,814
29				2,800	6.52	18,256	5,800	6.52	37,814
							3,000	6.52	19,558

*Returned to supplier out of the quantity received on Nov. 4.

MISCELLANEOUS**Income statement with different elements of cost**

Problem 1'24. The manufacturing cost data of a factory is as under :

	<i>Work in Process</i>		<i>Finished Goods</i>		<i>Placed in Process</i>
	<i>Opening</i>	<i>Closing</i>	<i>Opening</i>	<i>Closing</i>	
Direct Material	160	400	900	1000	1000
Direct Labour	80	100	100	200	600
Factory Overheads	60	500	200	100	1200

Sales are Rs. 3,900 and selling and administration expenses are Rs. 900 for the year. (All figures are in Rs. '000). You are required to :

(a) Prepare an income statement with appropriate supporting schedules ;

(b) Compute the elements of cost in the cost of goods sold.

(I.C.W.A. Final, Dec., 1983)

Solution. (a) Before income statement is prepared, it is necessary to find out cost of goods produced and cost of goods sold.

Statement showing cost of goods produced

	(Rs. '000) .
Opening W.I.P. (total of three elements)	300
Placed in process (,, ,,)	2,800
Total	3,100
Less Closing W.I.P (,, ,,)	1,000
Cost of goods produced	2,100
	== =

Statement showing the cost of goods sold

Opening stock of finished goods	1,200
Add : Cost of goods produced	2,100
Cost of goods available for sale	3,300
Less : Closing stock of finished goods	1,300
Cost of goods sold	2,000
	== =

Statement showing the income statement

Sales	3,900
Less : Cost of goods sold	2,000
Gross profit	1,900
Less : Selling and admn. expenses	900
Net income	1,000
	== =

(b) Statement showing the elementwise cost of goods sold

(Rs. '000)							
WIP opening	Placed in process	WIP closing	Cost of goods produced	Finished goods opening	Available for sale	Finished goods closing	Cost of goods sold
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
			(1+2-3)		(4+5)		(6-7)
<hr/>							
Direct							
Material 160	1,000	400	760	900	1,660	1,000	660
Direct							
labour 80	600	100	580	100	680	200	480
Factory							
overheads 60	1,200	500	760	200	960	100	860
	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
Total	300	2,800	1,000	2,100	1,200	3,300	2,000
	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>

Tax advantage due to adoption of LIFO Method

Problem 1'25. (a) Explain the advantages to a company adopting the Last-in First-out method of stores valuation at a period of rising prices.

(b) Retailers Ltd. buy and sell finished goods after carrying out some operations. They began the year with 3,000 units valued at Rs. 3 per unit. During the year they sold 25,000 units for an average sale price of Rs. 10 per unit. Purchases were as follows :

4,000 units @ Rs. 5 per unit

16,000 units @ Rs. 6 per unit

6,000 units @ Rs. 7 per unit

The current replacement cost of the unit is Rs. 8 and the Company's Taxation Manager advises that there may be significant tax advantages of purchasing at year-end at this price, as the company uses the LIFO method and has got the acceptance of the tax authorities for consistently using this method in its assessments. The Corporate Tax averages 40%.

Bearing in mind that the warehouse space is limited to 10,000 units, work out the tax advantages and the cost of year end purchasing under this situation given that the operating expenses for the year are Rs. 37,000.
(C.A. Final, May 1983)

Solution :

(a) Please refer to *Advanced Cost Accounting by Saxena & Vashist.*
(b) **Retailers Ltd.**

Statement showing closing stock at year end

Total purchases during the year	26,000 Unit
Opening stock	3,000
	<hr/>
	29,000
Less : Units sold during the year	25,000
	<hr/>
Total closing stock	4,000
	<hr/>

Storage capacity is 10,000 units, year-end purchases can be up to 6,000 units.

**Profit statement without making year-end purchase
(LIFO method)**

Sales (25,000 × 10)	Rs. 2,50,000
Less : Cost of goods sold	
6,000 × 7 = Rs. 42,000	
16,000 × 6 = Rs. 96,000	
3,000 × 5 = Rs. 15,000	
	<hr/>
	1,53,000
Gross profit	97,000
Less : Operating expenses (given)	37,000
	<hr/>
Taxable Income	60,000
Less : Income tax @ 40%	24,000
	<hr/>
Profit after tax	36,000

**Profit statement after year-end purchase of 6,000 units at
current replacement cost**

Sales (25,000 × Rs. 10)	Rs. 2,50,000
Less : Cost of good sold	Rs.
6,000 units @ Rs. 8 = 48,000	
6,000 units @ Rs. 7 = 42,000	
13,000 units @ Rs. 6 = 78,000	
	<hr/>
	1,68,000
Gross profit	82,000
Less : Operating expenses	37,000
	<hr/>
Taxable Income	45,000
Less : Income tax @ 40%	18,000
	<hr/>
Profit after tax	27,000

Tax Advantage. By accepting the advice of Taxation Manager, Retailers Ltd. will be able to effect a tax saving of Rs. 6,000, i.e., Rs. 24,000—Rs. 18,000.

Cost of year-end purchase : 6,000 units @ Rs. 8=	Rs. 48,000
Less : Tax advantage	6,000
Effective cost of closing inventory	<u>42,000</u>

Effective cost per unit of year-end purchase Rs. $42,000 \div 6,000 = \text{Rs. } 7$.

ABC Analysis

Problem 1-26 (EOQ). (a) The Purchase Department of your organisation has received an offer of quantity discounts on its orders of materials as under :

Price per tonne	Tonnes
Rs. 1,200	Less than 500
1,180	500 and less than 1,000
1,160	1,000 and less than 2,000
1,140	2,000 and less than 3,000
1,120	3,000 and above

The annual requirement for the material is 5,000 tonnes. The delivery cost per order is Rs. 1,200 and the stock holding cost is estimated at 20% of material cost per annum.

You are required to advise the Purchase Department the most economical purchase level.

(b) From the following data for the year ended 31st December, 1986, calculate the inventory turnover ratio of the two items, and put forward your comments on them.

	Material A	Material B
Opening stock 1/1/1986	Rs. 10,000	Rs. 9,000
Purchases during the year	52,000	27,000
Closing stock 31/12/1986	6,000	11,000

(I.C.W.A. Inter December, 1987)

Solution. (a) Statement showing the most economic purchase level

	400	500	1,000	2,000	3,000
1. Order Size (tonne)					
2. No. of orders (Annual requirement ÷ order size)	12.5	10	5	2.5	1.67
3. Value of order (Order size × Price per tonne) (Rs. '000)	480	590	1,160	2,280	3,360
4. Average inventory (Value per order ÷ 2) (Rs. '000)	240	295	580	1,140	1,680
5. Ordering Cost (No. of order × ordering cost per					

order) (Rs. 1,200)	15,000	12,000	6,000	3,000	2,000
Carrying cost (20% of item 4)	48,000	59,000	1,16,000	2,28,000	3,36,000
Total of 5	63,000	71,000	1,22,000	2,31,000	3,38,000
Add : Annual cost of material (Annual demand × Price per tonne	60,00,000	59,00,000	58,00,000	57,00,000	56,00,000
Total annual cost	60,63,000	59,71,000	59,22,000	59,31,000	59,38,000

Rs. 59,22,000 is the total minimum cost at 1,000 order size.

Therefore, the most economical purchase level is 1,000 tonnes.

(b) First of all it is necessary to find out the cost of material consumed

Cost of Materials consumed	Material A	Material B
Opening stock	Rs. 10,000	Rs. 9,000
Add : Purchases	52,000	27,000
	62,000	36,000
Less : Closing stock	6,000	11,000
Materials consumed	56,000	25,000
Average inventory (Op. Stock + Cl. Stock) ÷ 2	8,000	10,000
Inventory Turnover ratio (Consumption ÷ Avg. inventory)	7 times	2.5 times
Inventory Turnover (No. of days) (No. of days in a year ÷ I.T. Ratio)	52 days	146

Comments : Material A is more fast moving than Material B.

Closing Stocks Valuation of Budgeted Raw Material Purchases

Problem 127. The following details apply to an annual budget for a manufacturing company :

Quarter	1st.	2nd	3rd	4th
Working days	65	60	55	60
Production (units per working day)	100	110	120	105
Raw material purchases (% by weight of annual total)	30%	50%	20%	—
Budgeted purchase price (per kg.)	Rs. 1	1.05	1.125	—

Quantity of raw material per unit production : 2 kg.

Budgeted opening stock of raw material—4,000 kg. (cost Rs. 4,000).

Budgeted closing stock of raw material : 2,000 kg.

Issues are priced on FIFO basis.

Calculate the following budgeted figures :

MATERIALS**P139****(a) Quarterly and annual purchases of raw material, by weight and value.****(b) Closing quarterly stock by weight and value.***(I.C.W.A. Inter, Dec. 1982)***Solution.****Consumption****Kg.**

Quarter	Days	Production per day	Qty. of R.M. per unit of production	
1st	65	× 100	× 2	13,000
2nd	60	× 110	× 2	13,200
3rd	55	× 120	× 2	13,200
4th	60	× 105	× 2	12,600
Total consumption for the year				52,000

We know that :

Consumption = Opening stock + Purchases - Closing stock

 Purchases = Consumption + Closing stock - Opening stock
 = 52,000 + 2,000 - 4,000 or 50,000 kg.
(a) Purchases :

Quarter	Kg.	Purchase price	Value Rs.
1st	50,000 × 30% i.e., 15,000 ×	1.00 =	15,000
2nd	50,000 × 50% i.e., 25,000 ×	1.05 =	26,250
3rd	50,000 × 20% i.e., 10,000 ×	1.125 =	11,250
			52,500

(b) Closing quarterly stocks by weight and value :

1st Quarter (FIFO method)	Quantity Kg.	Rate Rs.	Value Rs.
Opening stock	4,000	1.00	4,000
Purchases	15,000	1.00	15,000
Total	19,000		19,000
Less : Consumption	13,000	1.00	13,000
Closing stock	6,000	1.00	6,000

2nd Quarter.

	Quantity Kg.	Rate Rs.	Value Rs
Opening stock	6,000	1.00	6,000
Purchases	25,000	1.05	26,250
Total	31,000		32,250
Less : Consumption	13,200		13,560*
Closing stock	17,800		18,690

* 6,000 @ Re. 1.00 = 6,000

7,200 @ Rs. 1.05 = 7,560

13,200	13,560
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3rd Quarter

Opening stock	17,800	1.05	18,690
Purchases	10,000	1.125	11,250
Total	27,800		29,940
Less : Consumption	13,200	1.05	3,860
Closing stock	14,600		16,080

4th Quarter

Opening stock	14,600		16,080
Purchases	—		—
Total	14,600		16,080
Less : Consumption	12,600		13,830*
Closing stock	2,000		2,250

* 4,600 (17,800--13,200) @ Rs. 1.05 4,830

8,000 @ Rs. 1.125 9,000

12,600	13,830
--------	--------

Authors' Special Notes

1. This chapter is primarily relevant to Intermediate level.
2. Total cost of inventory is the aggregate of Ordering cost, Carrying cost of average inventory and Purchase cost (Problems 1'1 and 1'2).
3. If *EOQ* is to be ignored for availing discount or due to specific managerial decision, then determine the total cost of inventory for both the alternatives under consideration and take decision accordingly (Problem 1'2)
4. At final level, direct questions are not asked. Note (i) Problem 1'17—Application of net realisable value concept on sampling basis, (ii) Problem 1'21—Disclosure of inventory in published accounts, (iii) Determination of accretion/decretion of opening/closing inventory of WIP and Finished Goods for computation of income (Problem 1'24) and (iv) taking tax advantage due to inventory decisions (Problem 1'25)

**BREAK-UP OF PROBLEMS RELATING TO MATERIALS
ACCORDING TO DIFFERENT LEVELS
(FOR PROBLEMS WITH PREFIX A, REFER
TO APPENDIX A)**

Intermediate Level

Inventory levels—P 1'5, 1'7, 1'10, 1'26, A-61

Valuation of Materials—P 1'14, 1'15, 1'16, 1'18, 1'19, 1'20, 1'22, 1'23, A-71, A-88

Miscellaneous—P 1'27

Final Level

Inventory Levels—P 1'1, 1'2, 1'3, 1'4, 1'8, 1'9, 1'11, 1'12, 1'13, A-74

Valuation of materials—P 1'17, 1'21

Miscellaneous—P 1'24, 1'25

Please also refer to the Examples 2'1 to 2'20 of the book "Advanced Cost and Management Accounting -Text" by Saxena and Vashist.

Labour

[Labour Cost 2-1—2-2; Remuneration and Incentives 2-3—2-15; Labour Turnover 2-16—2-18; Miscellaneous 2-19—2-20]

LABOUR COST

Labour and total cost of a job

Problem 2-1. Following are the particulars for April 1986 relating to four employees working in Department 'M' of a factory, exclusively for job No. 120 :

<i>Name</i>	<i>Designation</i>	<i>Wages Rs.</i>	<i>Per</i>
A	Foreman	800	month
B	Mechanic	15	day
C	Machine Operator	12	day
D	Workman	10	day

The normal working hours per week of six days are 48, at 8 hours per day. Sundays are paid holidays. (There were no other holidays during the month.)

Provident Fund Contribution was 8% of monthly wages by employee.

Provident Fund Contribution was 8% of monthly wages by employer.

Employee State Insurance Contribution was 3% of monthly wages by employee and 5% of monthly wages by employer.

From the foregoing data, calculate—

- Net wages payable by the employer for the month ;
- The total amount of Provident Fund Contribution to be deposited by employer ;
- Employee State Insurance Contribution to be deposited by employer ;
- Total labour cost to the employer for the month of April, chargeable to the job ; and
- The total cost of the job requiring materials valued at Rs. 6,000 and overheads at 50% of prime cost.

(I.C.W.A. Inter, Dec. 1986)

Solution.**(a) Net wages payable by the employer for the month**

1. Gross wages for April 1986	Rs.
(a) Foreman @ Rs. 800 p.m.	800
(b) Mechanic @ Rs. 15 per day \times 30 days	450
(c) Machine Operator Rs. 12 per day \times 30 days	360
(d) Workman @ Rs. 10 per day \times 30 days	300
	<u>1,910</u>
2. Less : Deductions :	
(i) Provident Fund @ 8% of Rs. 1,910	152.80
(ii) Employee State Insurance by employee @ 3% of Rs. 1,910	57.30
	<u>210.10</u>
3. Net wages payable (1 - 2)	<u>1,699.90</u>
(b) Employee's share of Provident Fund (8% of Rs. 1,910)	152.80
Employer's share of Provident Fund (8% of Rs. 1,910)	152.80
Total amount of Provident Fund contribution to be deposited by employer	<u>305.60</u>
(c) Employee's share of E.S.I. (3% of Rs. 1,910)	57.30
Employer's share of E.S.I. (5% of Rs. 1,910)	95.50
	<u>152.80</u>
(d) Total labour cost to employer :	
Total gross wages	1,910.00
Add : Contribution to P.F. (employer)	152.80
Contribution to E.S.I. (")	95.50
	<u>2,158.30</u>
(e) Total cost of job :	
Material (given)	6,000.00
Labour (as above)	<u>2,158.30</u>
Prime cost	8,158.30
Overhead at 50% of prime cost	<u>4,079.15</u>
Total Cost of the job	<u><u>12,237.45</u></u>

Labour and total cost of a repair job

Problem 22. It is seen from the job card for the repair of a customer's equipment that total of 154 labour hours have been put in as detailed below :

<i>March 1986</i>	<i>Worker A paid at Rs. 2 per day of 8 hrs.</i>	<i>Worker B paid at Re. 1 per day of 8 hrs.</i>	<i>Supervisor Worker C paid at Rs. 3 per day of 8 hrs.</i>
Monday	10½ hrs.	8 hrs.	10½ hrs.
Tuesday	8 hrs.	8 hrs.	8 hrs.
Wednesday	10½ hrs.	8 hrs.	10½ hrs.
Thursday	9½ hrs.	8 hrs.	9½ hrs.
Friday	10½ hrs.	8 hrs.	10½ hrs.
Saturday	—	8 hrs.	8 hrs.
	-----	-----	-----
	49 hrs.	48 hrs.	57 hrs.
	-----	-----	-----

In terms of an award in a labour negotiation, the workers are to be paid dearness allowance on the basis of the cost of living index figures relating to each month, which works out at Rs. 96 for the month of March, 1986. The dearness allowance is payable to all workers irrespective of wage rates, if they are present or are on leave with wages on all working days.

Sunday is weekly holiday and each worker has to work for 8 hours on all week days and 4 hours on Saturday; but the workers are, however, paid full wages for Saturday (8 hours wages for 4 hours work).

Workers are paid overtime according to Factories Act, for the hours worked in excess of the normal working hours on each day. Excluding holiday (including the 4 hours work to be put in on Saturday) the total number of hours of work to be put in comes to 192 in the month of March, 1986.

The company's contribution to Provident Fund and Employees' State Insurance Premium are absorbed as overheads.

This job has consumed material worth Rs. 250 and machine facilities (10 hrs.) Rs. 45. Overheads are chargeable @ 150% of labour wages and Rs. 2 per machine hour.

What is the total cost of the job?

(C.A. Final)

Solution. Statement showing Computation of Normal and Overtime hours

	<i>Worker A</i>		<i>Worker B</i>		<i>Supervisor Worker C</i>	
	<i>Normal</i>	<i>Overtime</i>	<i>Normal</i>	<i>Overtime</i>	<i>Normal</i>	<i>Overtime</i>
Monday	9	1½	8	—	9	1½
Tuesday	8	—	8	—	8	—
Wednesday	9	1½	8	—	9	1½
Thursday	9	½	8	—	9	½
Friday	9	1½	8	—	9	1½
Saturday	—	—	8	—	8	—
	44	5	48	—	52	5

Workers are paid full wages for Saturday, i.e., 8 hours' wages for 4 hours' work. *B* has not worked for more than 48 hours (including 8 hrs. work on Saturday) during the week. Thus, under the Factories Act, he is not entitled to any overtime wages. As supervisor *C* has also not worked more than 9 hrs. a day during the week, he is also not entitled to overtime wages. Since *B* and *C* have worked 8 hours on Saturday, it is necessary to add 4 hours each to their normal hours' work during the week. Thus, their total number of hours worked will be 52 and 56 respectively.

Computation of Labour Cost

	<i>A</i>	<i>B</i>	<i>C</i>
Hours worked (normal)	44	52	56
Overtime (hours)	5	—	5
Wage rate per day of 8 hours	Rs. 2	Rs. 1	Rs. 3
Dearness allowance (Rs. 96 for 192 hours or Rs. 0.50 per hour)			
D.A. for one day of 8 hours (Rs.)	4	4	4
Normal rate per day of 8 hours (Rs.)	6	5	7
Rate per hour (Rs.)	0.75	0.625	0.875
Wages at normal rate	44 × 0.75	52 × 0.625	56 × 0.875
	= Rs. 33.00	= Rs. 32.50	= Rs. 49.00
Overtime wages (twice the normal rate)	7.50	—	8.75
Total	40.50	32.50	57.75

Total Cost of the Repair Job

Materials		Rs. 250.00
Labour cost as per above workings :		
Worker A	40.50	
B	32.50	
C	57.75	130.75
	<hr/>	
Machine facilities (10 hours)		45.00
Overhead :		
(a) 150% of direct wages ($130.75 \times 150\%$)		196.13
(b) Rs. 2 per machine hour for 10 hours		20.00
		<hr/>
Total Cost		641.88

REMUNERATION AND INCENTIVES

Award payable to employees for suggestions

Problem 23. A company uses an old method of machining a part manufactured for sale. The estimates of operating details for the year 1987-88 are as under :

No. of parts to be manufactured and sold 30,000.

Raw materials required per part : 10 kg. @ Rs. 2 kg.

Average wage rate per worker : Rs. 40 per day of 8 hrs.

Average labour efficiency 60%.

Standard time required to manufacture one part 2 hrs.

Overhead rate Rs. 10 per clock hour.

Material handling expenses—2% of the value of raw materials.

The company has a suggestion box scheme and an award equivalent to three months' saving in labour cost is passed on to the employee whose suggestion is accepted. In response to this scheme, a suggestion has been received from an employee to use a special Jig in the manufacture of the aforesaid part. The cost of the Jig which has life of one year is Rs. 3,000 and the use of the Jig will reduce the standard time by 12 minutes.

Required :

- (i) Compute the amount of award payable to the employee who has given the suggestion.
- (ii) Prepare a statement showing the annual cost of production before and after the implementation of the suggestion to use the Jig and indicate the annual savings.
- (iii) State the assumptions on which your calculations are based.

(I.C.W.A. Inter, June, 1987)

Solution. (i) Amount of Award payable to the employee

Wage rate per hour (Rs. $40 \div 8$)	= Rs. 5 per hour
Standard time for one part	= 2 hours
Standard time for 30,000 parts	= 60,000 hrs.
Average labour efficiency	= 60%
Actual time	= $60,000 \div 60\% = 1,00,000$ hrs.
Actual labour cost ($1,00,000$ hrs. \times Rs. 5)	= Rs. 5,00,000
Standard time for one part	= 2 hrs.
Less : Saving in standard time	= 12 minutes
Revised standard time	= 1 hrs. 48 minutes or 1.8 hrs.
Adjusted to 60% efficiency	= $1.8 \text{ hrs.} \div 60\% = 3$ hrs.
Revised actual time for 30,000 parts	= $3 \text{ hrs.} \times 30,000 = 90,000$ hrs.
Revised wages	= $90,000 \text{ hrs.} \times \text{Rs. } 5 = \text{Rs. } 4,50,000$
Annual Saving in wages (Rs. $5,00,000 - 4,50,000$)	= Rs. 50,000
Award to the employee (Rs. $50,000 \div 3/12$)	= Rs. 12,500

(ii) Statement showing the cost of production for 30,000 parts before and after implementation of the suggestion

	Before implementation	After implementation
	Rs.	Rs.
Raw Materials cost @ Rs. 20	6,00,000	6,00,000
Wages	5,00,000	4,50,000
Prime Cost	11,00,000	10,50,000
Overhead Rate @ Rs. 10 per hr. (actual)	10,00,000	9,00,000
Award to employee	—	12,500
Material handling expenses	12,000	12,000
Cost of Jig	—	3,000
Total	21,12,000	19,77,500
Annual savings		Rs. 1,34,500

(iii) It is assumed that labour efficiency of 60% holds good even after implementation of the suggestion and the capacity saved is utilized for other jobs.

Earnings under combination of Time and Piece Rate Methods

Problem 2.4. The three workers Govind, Ram and Shyam produced 80, 100 and 120 pieces of a product 'X' on a particular day in May 1987 in a factory. The time allowed for 10 units of product X is 1 hour

and their hourly rate is Rs. 4. Calculate for each of these three workers the following :

- (1) Earnings for the day, and
 - (2) Effective Rate of Earnings per hour under
 - (a) Straight piece-rate (b) Halsey Premium Bonus (50% sharing)
 - and (c) Rowan Premium Bonus—methods of Labour Remuneration.
- (I.C.W.A. Inter, June 1987)

Solution.

(1) Earnings for the day

(Units produced \times Time Allowed \times Rate)

Govind—80 units \times 1/10 hr. \times Rs. 4 = Rs. 32

Ram—100 units \times 1/10 hr. \times Rs. 4 = Rs. 40

Shyam—120 units \times 1/10 hr. \times Rs. 4 = Rs. 48

(2) Effective rate of earnings per hour :

(a) Straight piece rate :

	Govind	Ram	Shyam
(i) Remuneration for the day	Rs. 32	Rs. 40	Rs. 48
(ii) Output for the day	80 units	100 units	120 units
(iii) Remuneration per unit (i \div ii)	Rs. 0.40	Rs. 0.40	Rs. 0.40
(iv) Time taken for one unit	0.1 hr.	0.1 hr.	0.1 hr.
(v) Rate per hour (iii \div iv)	Rs. 4	Rs. 4	Rs. 4

(b) Halsey Premium Bonus

Earnings = Hours worked \times Rate per hour + 50% of Time Saved \times Rate per hr.

Statement of time Saved

Name of worker	Actual output in pieces	Time allowed for the output*	Actual Time	Time Saved
Govind	80	8 hrs.	8 hrs.	—
Ram	100	10 "	8 "	2 hrs.
Shyam	120	12 "	8 "	4 hrs.

*Actual output \times Time allowed for one unit

Name of worker	Total earnings for the day	Effective rate of earning per hr.
Govind	8 hrs. \times Rs. 4 = Rs. 32*	Rs. 32 \div 8 = Rs. 4.00
Ram	8 hrs. \times Rs. 4 + 50% of 2 hrs \times Rs. 4 = Rs. 36	Rs. 36 \div 8 = Rs. 4.50
Shyam	8 hrs. \times Rs. 4 + 50% of 4 hrs. \times Rs. 4 = Rs. 40	Rs. 40 \div 8 = Rs. 5.00

*Time saved is nil.

(c) Rowan Premium BonusEarnings = Hours worked \times Rate per hr.

$$+ \left(\frac{\text{Time saved}}{\text{Time allowed}} \times \text{Hrs. worked} \times \text{Rate per hour} \right)$$

<i>Name of worker</i>	<i>Total earnings for the day</i>	<i>Effective rate per hour</i>
Govind	8 hrs. \times Rs. 4 = Rs. 32*	Rs. 32 \div 8 = Rs. 4
Ram	8 hrs. \times Rs. 4 $+ \left(\frac{2}{0} \times 8 \times \text{Rs. 4} \right)$ = Rs. 38.40	Rs. 38.40 \div 8 = Rs. 4.80
Shyam	8 hrs. \times Rs. 4 $+ \left(\frac{4}{12} \times 8 \times \text{Rs. 4} \right)$ Rs. 42.67	Rs. 42.67 \div 8 = Rs. 5.33.

*Time saved is nil.

Average Labour Cost under Various Incentive Schemes

Problem 25. Wage negotiations are going on with the recognised Labour Union and the Management wants to ask the Cost Accountant of the Company to formulate an incentive scheme with a view to increase productivity.

The case of three typical workers Achyuta, Ananta and Govinda who produce respectively 180, 120 and 100 units of the Company's product in a normal day of 8 hours is taken up for study.

Assuming that day wages would be guaranteed at 75 paise per hour and the piece rate would be based on a standard hourly output of 10 units, calculate the earnings of the three workers and the labour cost per 100 pieces under (i) Day wages, (ii) Piece rate, (iii) Halsey scheme, and (iv) The Rowan scheme.

Also calculate under the above schemes the average cost of labour for the company to produce 100 pieces. (A. Inter May, 1986)

Solution. (i) **Statement showing the earnings of 3 workers on day basis and labour cost for 100 pieces**

<i>Name of worker</i>	<i>Actual output (units)</i>	<i>Day wages @ Rs. 0.75 per hour for 8 hrs.</i>	<i>Labour cost per 100 pieces</i>
Achyuta	180	Rs. 6.00	(6 \times 100) \div 180 = 3.33
Ananta	120	6.00	5.00
Govinda	100	6.00	6.00
	<u>400</u>	<u>18.00</u>	

Average cost of labour to produce 100 pieces

For 400 pieces, labour cost = Rs. 18

For 100 pieces, labour cost = $(18 \times 100) \div 400$ or Rs. 4.50.

(ii) 10 units (standard hourly output) = Re. 0.75

1 unit = Re. $0.75 \div 10$ = Rs. 0.075

100 units = Rs. 7.50

Statement showing the earnings of 3 workers on piece rate basis and labour cost per 100 pieces

Name of worker	Actual output (units)	Piece wages @ Re. 0.075 per unit	Labour cost per 100 pieces
Achyuta	180	Rs. 13.50	Rs. 7.50
Ananta	120	9.00	7.50
Govinda	100	7.50	7.50
	<u>400</u>	<u>30.00</u>	
	==	==	

Average cost of labour $\frac{30}{400} \times 100$ = Rs. 7.50 per 100 pieces.

(iii) **Statement showing the earnings of 3 workers under Halsey scheme and labour cost per 100 pieces**

Earnings = Hours worked \times Rate per hour +

$$\left(\frac{50}{100} \times \text{Time saved} \times \text{Rate per hour} \right)$$

Name of worker	Actual output (pieces)	Std. time for actual output (Hours)	Actual time taken (Hours)	Time saved (Hours)
Achyuta	180	$180 \div 10^ = 18$	8	10
Ananta	120	12	8	4
Govinda	100	10	8	2

*One standard hour = 10 units.

Earnings under Halsey Scheme

Name of worker	Earnings (Rs.)	Labour cost per 100 pieces (Rs.)
Achyuta	$8 \times 0.75 + (50 \div 100 \times 10 \times 0.75)$ = 6.00 + 3.75 = Rs. 9.75	$(9.75 \times 100) \div 180$ = Rs. 5.42
Ananta	$8 \times 0.75 + (50 \div 100 \times 4 \times 0.75)$ = 6.00 + 1.50 = Rs. 7.50	$(7.50 \times 100) \div 120$ = Rs. 6.25
Govinda	$8 \times 0.75 + (50 \div 100 \times 2 \times 0.75)$ = 6 + 0.75 = Rs. 6.75	$(6.75 \times 100) \div 100$ = Rs. 6.75

Total earnings of 3 workers = Rs. $(9.75 + 7.50 + 6.75) = \text{Rs. } 24.00$

Average cost $\left(\frac{24}{400} \times 100 \right) = \text{Rs. } 6 \text{ per } 100 \text{ pieces.}$

(iv) **Statement showing the earnings of 3 workers under Rowan Scheme and labour cost per 100 pieces**

Earnings = Hours worked \times Rate per hour

$$+ \left(\frac{\text{Time Saved}}{\text{Time allowed}} \times \text{Hours worked} \times \text{Rate per hour} \right)$$

Name of worker	Earnings	Labour cost per 100 pieces
Achyuta	$8 \times 0.75 + \left(\frac{10}{18} \times 8 \times 0.75 \right)$ = Rs. $6.00 + 3.33 = \text{Rs. } 9.33$	$\frac{100}{180} \times 9.33 = 5.18$
Ananta	$8 \times 0.75 + \left(\frac{4}{12} \times 8 \times 0.75 \right)$ = Rs. $6.00 + 2.00 = \text{Rs. } 8.00$	$\frac{100}{120} \times 8 = 6.67$
Govinda	$8 \times 0.75 + \left(\frac{2}{10} \times 8 \times 0.75 \right)$ = Rs. $6.00 + 1.20 = \text{Rs. } 7.20$	$\frac{100}{100} \times 7.20 = 7.20$

Total earnings Rs. $9.33 + 8.00 + 7.20 = \text{Rs. } 24.53$

Average labour cost for 100 pieces = $\frac{24.53}{400} \times 100 = \text{Rs. } 6.13.$

Computation of wages under various methods of wage payment

Problem 2.6. In an engineering factory, wages are paid on a weekly basis (48 hours per week) at a guaranteed hourly rate of Rs. 3.00. A study has revealed that the time required to manufacture a product is 12 minutes. However, a contingency allowance of 25% is to be added to this for normal idle time, setting-up time etc. During the first week of June 1986, Mr. X produced 224 pieces. Compute his wages for the particular week using the following methods of wage payment :

- (a) Time Rate ; (b) Piece Rate with a Guaranteed Time Rate ;
(c) Rowan Premium Bonus Scheme ; (d) Halsey Premium Bonus Scheme.
(I.C.W.A. Inter June, 1986)

Solution. (a) At Time Rate Wages = Hours worked \times Rate per hour
= 48 hours \times Rs. 3 = Rs. 144

(b) Piece Rate with a guaranteed time rate

Time required to manufacture a product	= 12 minutes
Add : Contingency allowance @ 25%	3 "
	<hr/>
	15 "
	= =

Hourly Rate (Given)	=Rs. 3
Piece Rate = $\frac{3}{60} \times 15$	=Re. 0.75
Piece Rate wages = 224×0.75	=Rs. 168
Guaranteed Time wage—Refer to (a)	=Rs. 144
Mr. X has to be paid Rs. 168 as wages.	

(c) **Rowan Scheme**

Time required to manufacture 1 piece = 15 minutes

Time required to manufacture 224 pieces

$$= \frac{15}{60} \times 224 \quad \text{Hours}$$

Hours worked 56

Time Saved 48

8

Earnings = Hours worked \times Hourly Rate

$$+ \left(\frac{\text{Time saved}}{\text{Time allowed}} \times \text{Hours worked} \times \text{Rate per hour} \right)$$

$$= 48 \times 3 + \left(\frac{8}{56} \times 48 \times 3 \right)$$

$$= \text{Rs. } 144 + 20.57 = \text{Rs. } 164.57.$$

(d) **Halsey Scheme**

Earnings = Hours worked \times Hourly Rate

$$+ \left(\frac{50}{100} \times \text{Time saved} \times \text{Hourly rate} \right)$$

$$= 48 \times 3 + (0.50 \times 8 \times 3)$$

$$= \text{Rs. } 144 + 12 = \text{Rs. } 156.$$

Earnings of worker under Rowan Scheme (Hours lost due to power cut)

Problem 2.7. A worker, whose day-work wages is Rs. 2.50 an hour, received production bonus under the Rowan Scheme. He carried out the following work in a 48-hour week :

Job 1 1,500 items at 4 hours per 1,000

Job 2 1,800 items at 3 hours per 1,000

Job 3 9,000 items at 6 hours per 1,000

Job 4 1,500 items for which no "standard time" was fixed and it was arranged that the worker would be paid a bonus of 25 per cent. Actual time on the job was 4 hours.

Job 5 2,000 items at 8 hours per 1,000, each item was estimated to be half-finished.

Job No. 2 was carried out on a machine running at 90 per cent efficiency and an extra allowance of $\frac{1}{9}$ th of actual time was given to compensate the worker.

4 hours were lost due to power cut. Calculate the earnings of the worker, clearly stating your assumptions for the treatment given by you for the hours lost due to power-cut. (I.C.W.A., Inter Dec., 1986)

Solution. For computing production bonus under the Rowan Scheme, it is necessary to find out the time saved.

Time Allowed

Job No.	Items produced (units)	Time allowed per 1,000 items	Hours allowed
1	1,500	4 hours	6 hour.
2	1,800	3	5.40 hrs.
		Add allowance $\frac{1}{9}$ th of actual time	0.60
3	9,000	6	54
4	1,500	4	
		+1 hrs. for 1,500 items i.e. (25% bonus)	5
5	2,000 half finished +1,000 items	8	8
Total time allowed			79

Time taken

Gross time	48 hours
Less lost time due to power cut	4
Net time taken	44 hours

Time Saved = 79 - 44 = 35 hours

Calculation of earnings (Rowan Scheme)

Earnings as per normal day wages + Bonus on time saved.

(Gross time taken \times Rate per hour)

$$+ \frac{\text{Time saved}}{\text{Time allowed}} \times \text{Time taken} \times \text{Rate per hour}$$

$$= (48 \times 2.50) + \left(\frac{35}{79} \times 44 \times 2.50 \right)$$

$$= \text{Rs. } 120 + \text{Rs. } 48.73 \text{ or Rs. } 168.73$$

Hours lost due to power cut are beyond the control of a worker. Therefore, 48 hours have been used for calculating normal day wages.

Direct wages cost and total earnings with bonus

Problem 2.8. The following particulars for the first week of September, 1984 relate to X and Y, two workers employed in a factory :

	X	Y
(a) Job completed (units)	3,600	4,200
(b) Out of above, output rejected and unsaleable	540	420
(c) Time allowed	12 minutes per dozen	3 hours for 200 units
(d) Basic wage rate per hour	Rs. 5	Rs. 6
(e) Hours worked	45	50

The normal working hours per week are fixed at 42 hours. Bonus is paid @ 2/3 of the basic wage rate for gross time worked and gross output produced without deduction of rejected output. The rate of overtime for first 4 hours is paid at time plus 1/3 and next 4 hours is paid at time plus 1/2.

From the above data, calculate for each employee :

- Number of bonus hours earned and amount of bonus earned.
- Total wages earned including basic wages, overtime premium and bonus.
- Direct wages cost per 100 saleable units.

(I.C.W.A., Inter, Dec. 1984)

Solution. (a) **Statement showing the number of bonus hours and amount of bonus earned**

	Worker X hours	Worker Y hours
1. Time allowed (12 minutes per dozen or one minute per unit of X)	$\left(\frac{1}{60} \times 3,600\right) = 60$	$\frac{3}{200} \times 4,200 = 63$
2. Hours worked	45	50
3. Hours for which bonus is earned (1-2)	15	13
4. Amount of bonus earned (Bonus hours \times Hourly wage rate $\times \frac{2}{3}$)	$X - 15 \times 5 \times \frac{2}{3} = \text{Rs. } 50$	$Y - 13 \times 6 \times \frac{2}{3} = \text{Rs. } 52$

(b) **Statement showing total wages earned**

Basic wages (X—45 hours \times Rs. 5)	Rs. 225	
(Y—50 hours \times Rs. 6)		Rs. 300

2. Overtime premium		
(Hours worked less Normal working hours)		
X— $(45-42) \times \text{Rs. } 5 \times \frac{1}{2}$	= 5	
Y—Total overtime worked		
(50—42—8 hours)		
For first 4 hrs. = $4 \times \text{Rs. } 6 \times \frac{1}{2}$ =		8
For second 4 hrs. = $4 \times \text{Rs. } 6 \times \frac{1}{2}$ =		12
3. Bonus as per (a) above	50	52
Total wages	Rs. 280	Rs. 372

Factory cost of job under Rowan and Halsey Systems

Problem 29. A worker takes 6 hours to complete a job under a scheme of payment by results. The standard time allowed for the job is 9 hours. His wage rate is Rs. 1.50 per hour. Material cost of the job is Rs. 16 and the overheads are recovered at 150% of the total direct wages. Calculate the factory cost of job under (a) Rowan and (b) Halsey Systems of Incentive Payments. (I.C.W.A., Inter June, 1985)

Solution.

Date given :

- | | |
|--------------------------------|-------------------|
| (i) Standard time for the job | 9 hours |
| (ii) Wage rate | Rs. 1.50 per hour |
| (iii) Time taken to do the job | 6 hours |

Wages earned under :

(a) Rowan System of Incentives Payment

Basic wages for time worked (6 hrs. \times Rs. 1.50)	Rs. 9.00
Incentive Bonus	

$$\left(\frac{\text{Time saved}}{\text{Time allowed}} \times \text{Time Taken} \times \text{hourly rate} \right)$$

$$= \frac{3 \text{ hrs.}}{9 \text{ hrs.}} \times 6 \text{ hrs} \times \text{Rs. } 1.50$$

Rs. 3.00

Total earnings

Rs. 12.00

(b) Halsey System of Incentives Payment

Basic wages for time worked	Rs.
(Rs. 1.5 \times 6 hrs.)	9.00
Incentive Bonus	

50% of time saved \times hourly rate

$$= \frac{1}{2} (3 \text{ hrs} \times \text{Rs. } 1.50)$$

2.25

11.25

Statement showing factory cost of job under two different systems of incentive payments.

	Rowan system	Halsey system
	Rs.	Rs.
Material	16'00	16'00
Labour	12'00	11'25
Factory overhead (15% of direct wages)	18'00	16'88
	<hr/> 46'00	<hr/> 44'13
	<hr/> <hr/>	<hr/> <hr/>

Remuneration and Incentives (Rowan and Halsey Scheme)

Problem. 2:10 Two workmen, Vishnu and Shiva, produce the same product using the same material. Their normal wage rate is also the same. Vishnu is paid bonus according to the Rowan system, while Shiva is paid bonus according to the Halsey system. The time allowed to make the product is 100 hours. Vishnu takes 60 hours while Shiva takes 80 hours to complete the product. The factory overhead rate is Rs. 10 per man-hour actually worked. The factory cost for the product for Vishnu is Rs. 7,280 and for Shiva it is Rs. 7,600. You are required :

- to find the normal rate of wages ;
- to find the cost of materials ;
- to prepare a statement comparing the factory cost of the products as made by the two workmen. (C.A. Inter, May 1988)

Solution. Working Notes

1. Let x be the cost of material and y be the normal rate of wage per hour.

Factory Cost of workman Vishnu

Material cost	Rs. x	
Wages.	$60y$	
Bonus under Rowan System		
$\frac{\text{Time saved}}{\text{Time allowed}} \times \text{Hrs. worked} \times \text{Rate per hr.}$		
$= 40 \div 100 \times 60 \times y$	$= 24y$	
Overhead, i.e., 60×10	600	
i.e. $x + 60y + 24y + \text{Rs. } 600 = \text{Rs. } 7280$		
or $x + 84y = \text{Rs. } 6680$		...(1)

Factory cost of workman Shiva

Material	Rs. x	
Wages	$80y$	
Bonus under Halsey Premium Plan		
$= \text{Hrs. Saved} \times 50 \div 100 \times \text{Rate per hr.}$		
$= 20 \times \frac{1}{2} \times y =$	$10y$	
Overhead 80×10	800	
i.e. $x + 80y + 10y + \text{Rs. } 800$	$= 7600$	
or $x + 90y$	$= \text{Rs. } 6,800$	...(2)

From (i) and (ii), value of $y=40$

\therefore Rate per hour = Rs. 20

2. Bonus paid to Vishnu = $24 \times \text{Rs. } 20 = 480$

3. Bonus paid to Shiva = $10 \times \text{Rs. } 20 = \text{Rs. } 200$.

(a) Normal Wages = Rs. 20 per hour as per Working Notes 1 and 2.

(b) The cost of material :

We know that $x + 90y = \text{Rs } 6,800$

or $x + 90 \times 20 = \text{Rs. } 6800$ or $x = \text{Rs. } 5000$

(c) Comparative statement of the factory cost of the product made by the two workmen

	Vishnu Rs. 5,000	Shiva Rs. 5,000
Material Cost		
D. wages { 60×20	1,200	
{ 80×20		1600
Bonus (Refer to Notes 1 and 2)	480	200
F. Overhead	600	800
Factory Cost	<u>7,280</u>	<u>7,600</u>

Production Bonus under Group Incentive Schemes

Problem 211. Both direct and indirect labour of a department in a factory are entitled to production bonus in accordance with a Group Incentive Scheme, the outlines of which are as follows :

(a) For any production in excess of the standard rate fixed at 10,000 tonnes per month (of 25 days) a general incentive of Rs. 10 per tonne is paid in aggregate. The total amount payable to each separate group is determined on the basis of an assumed percentage of such excess production being contributed by it, namely @ 70% by direct labour, @ 10% by inspection staff, @ 12% by maintenance staff and @ 8% by supervisory staff.

(b) Moreover, if the excess production is more than 20% above the standard, direct labour also get a special bonus @ Rs. 5 per tonne for all production in excess of 120% of standard.

(c) Inspection staff are penalised @ Rs. 20 per tonne for rejection by customer in excess of 10% of production.

(d) Maintenance staff are also penalised @ Rs. 20 per hour of breakdown.

From the following particulars for a month work out the production bonus earned by each group :

(a) Actual working days : 20.

(b) Production : 11,000 tonnes.

(c) Rejection by customer : 200 tonnes,

(d) Machine breakdown : 40 hours. (I.C.W.A., Inter. June, 1980)

Solution.

(i) No. of working days during month : 20.

(ii) Standard production for 20 days @ 10,000 tonnes

$$\text{per month of 25 days} = \frac{10,000 \times 20}{25} = 8,000 \text{ tonnes.}$$

(iii) Actual production during month : 11,000 tonnes.

(iv) Excess production during month

$$= 11,000 - 8,000 = 3,000 \text{ tonnes}$$

(v) Excess production above 20% of standard : 3,000 - 20% of 8,000

$$= 3,000 - 1,600 = 1,400 \text{ tonnes.}$$

Statement showing Bonus Earned by each Category of Staff

Category	General Incentive			Special Incentive		Penalty	Bonus earned
	%	Tonnes	Amount Rs.	Tonnes	Amount Rs.		
(a) Direct Labour	70	2,100	21,000	1,400	7,000	—	28,000
(b) Inspection Staff	10	300	3,000	—	—	1,800*	1,200
(c) Maintenance Staff	12	360	3,600	—	—	800**	2,800
(d) Supervisory Staff	8	240	2,400	—	—	—	2,400
Total	100	3,000	30,000	1,400	7,000	2,600	32,400

Remarks : * Penalty for rejection : 90 tonnes (i.e., 200 tonnes - 110 tonnes) @ Rs. 20 per tonne.

** Penalty for machine breakdown for 40 hours @ Rs. 20 per hour.

Calculation of bonus of Manager and Staff

Problem 212. Components for an assembly are produced under the control of the production manager. These are assembled and sold under the supervision of the sales manager. The production manager is entitled for a bonus payment for himself at 1/8th and the workers 7/8th of the difference between the notional value and the cost of production of the delivered components. The notional value is assessed at Rs. 5,18,500 for the components issued to assembly. The sales manager is entitled to a bonus of 2 1/4% of the profits for himself and 12 1/4% is distributed among his sales staff. The sales during a period amount to Rs. 65,000.

From the undermentioned particulars, detail the calculations involved in arriving at the bonus for both managers and the staff. Find also the impact of such bonus as a percentage of sales.

	Rs.
Raw materials at the beginning of the period	22,800
Raw materials at the end of the period	16,400
Purchases during the period	2,48,600
Wages—Production	46,200
Wages—Assembly	18,100
Overheads—Production	2,12,500
Overheads—Sales	45,200
Credit for scrap realised pertaining to components	8,700
Work-in-progress of production at the beginning	12,500
Work-in-progress of production at the end	18,200
Completed assemblies at the beginning	36,000
Completed assemblies at the end	24,030
Net realisation on assemblies sold	6,50,000

(I.C.W.A. Inter, June 1983)

Solution. Cost of Production of the Components

Work-in-progress (opening)	Rs. 12,500
Raw materials consumed (Opening stock + Purchases - Closing stock)	2,55,000
Wages—production	46,200
Overhead—production	2,12,500
Total	5,26,200
Less : Credit for scrap realised	8,700
	5,17,500
Less : Work-in-progress (closing)	18,200
Cost of production excluding bonus (a)	4,99,300
Notional value	5,18,500
Difference between notional value and cost of production	19,200
Bonus to Production Manager $\left(\frac{1}{8} \times 19,200 \right)$	2,400
Bonus to workers $\left(\frac{7}{8} \times 19,200 \right)$	16,800
Total bonus (b)	19,200
Cost of the components delivered (a+b)	5,18,500

Cost of Sales of the Components

	Rs.
Cost of the components delivered	5,18,500
Wages—Assembly	18,100
Overheads—sales	45,200
Completed assembly (opening)	36,000
Total	6,17,800
Less : Completed assembly (closing)	24,030
Cost of sales excluding bonus (a)	5,93,770
Selling price	6,50,000
Profit (before bonus)	56,230
Bonus to Sales Manager $\left(56,230 \times \frac{5}{200} \right)$	1,406
Bonus to sales staff $\left(56,230 \times \frac{25}{200} \right)$	7,029
Total bonus (sales) (b)	8,435
Cost of sales including bonus (a + b)	6,02,205
Profit (net)	47,795
Selling price	6,50,000
Impact of Bonus on Sales	
Bonus—Production	19,200
Bonus—Sales	8,435
Total bonus	27,635
Bonus as a % of sales $\left(\frac{27,635}{6,50,000} \times 100 \right)$	4.25%

Computation of total wages cost including bonus

Problem 2-13. In a factory bonus system, bonus hours are credited to the employee in the proportion of time taken which time saved bears to time allowed. Jobs are carried forward from one week to another. No overtime is worked and payment is made in full for all units worked on, including those subsequently rejected.

From the following information you are required to calculate for each employee—

- the bonus hours and amount of bonus earned,
- the total wages cost, and
- the wages cost of each good unit produced.

	<i>A</i> Rs.	<i>B</i> Rs.	<i>C</i> Rs.
Basic wage—rate per hour (Re.)	0·25	0·40	0·30
Units produced	2,500	2,200	3,600
Time allowed per 100 units	2 hrs. 36 min.	3 hrs.	1 hr. 30 min.
Time taken	52 hours	75 hours	48 hours
Rejects	100 units	40 units	400 units

(I.C.W.A. Inter, Dec., 1982)

Solution.

**Statement Showing the Bonus Hours, Amount of Bonus
Earned, Total Wages Cost and Wages Cost of
Each Good Unit Produced**

Sl. No.	Particulars	<i>Employee</i>		
		<i>A</i>	<i>B</i>	<i>C</i>
1.	Total units produced (Nos.)	2,500	2,200	3,600
2.	Less units rejected (Nos.)	100	40	400
3.	Good units (1—2)	2,400	2,160	3,200
4.	Time allowed for 100 units (hrs.)	2·6	3·0	1·5
5.	Total time allowed for total units produced (hrs.)	65	66	54
6.	Time taken (hrs.)	52	75	48
7.	Time saved (Bonus hours) (5—6)	13	—	6
8.	Basic rate per hour (Re.)	0·25	0·40	0·30
9.	Bonus earned	Rs. 2·60*	Rs. —	Rs. 1·60*
10.	Basic wage (Time taken × basic rate per hour)	13·00	30·00	14·40
11.	Total wage cost (9+10)	15·60	30·00	16·00
12.	Wages cost per unit of good output (11 ÷ 3)	0·0065	0·0139	0·0050

$$* \frac{\text{Time taken}}{\text{Time allowed}} \times \text{rate per hour} \times \text{time saved}$$

$$A = \frac{52}{65} \times 0·25 \times 13 = \text{Rs. } 2·60 ; \quad C = \frac{48}{54} \times 0·30 \times 6 = \text{Rs. } 1·60.$$

Computation of total earnings under Group Bonus Scheme

Problem 2·14. In a unit, 10 men work as a group. When the production of the group exceeds the standard output of 200 pieces per

hour, each man is paid an incentive for the excess production in addition to his wages at hourly rates. The incentive is at half the percentage, the excess production over the standard bears to the standard production. Each man is paid an incentive at the rate of this percentage of a wage rate of Rs. 2 per hour. There is no relation between the individual workman's hourly rate and the bonus rate.

In a week, the hours worked are 500 hours and the total production is 1,20,000 pieces.

a) Compute the total amount of the bonus for the week.

b) Calculate the total earnings of two workers A and B of the group :

A worked 44 hours and his basic rate per hour was Rs. 2.20.

B worked 48 hours and his basic rate per hour was Rs. 1.90.

(C.A., Inter, Nov. 1984)

Solution.

Actual production during the week	1,20,000 pieces
Standard production during the week of 500 hours @ 200 pieces per hour	1,00,000 pieces
	<u>20,000 pieces</u>

Excess production as a percentage of standard production

$$= \frac{20,000}{1,00,000} \times 100 = 20\%$$

Incentive is half of 20% i.e. 10%. Incentive is to be paid at the rate of this percentage over a wage rate of Rs. 2.00 per hour. Thus Incentive rate is Re. 0.20 per hour i.e. 10% of Rs. 2.00.

(a) Total amount of bonus for week

$$= \frac{500 \text{ hrs.} \times \text{Rs. } 2.00 \times 10}{100} \quad \text{or} \quad \text{Rs. } 100$$

(b) Total earnings of the workers A and B of the group.

	Amount Rs.
A's wages (44 hrs. × Rs. 2.20)	96.80
A's incentive (44 hrs. × Re. 0.20)	8.80
A's Earnings	<u>105.60</u>
B's wages (48 hrs. × Rs. 1.90)	91.20
B's incentive (48 hrs. × Re. 0.20)	9.60
	<u>100.80</u>
	<u>==</u>

Total earnings based on cost saving towards labour and overheads

Problem 2.15. In a manufacturing concern bonus to workers is paid on a slab rate based on cost saving towards labour and overheads. The following are the slab rates :

(i) upto 10% saving	5% of the earning
(ii) upto 15% saving	9% of the earning
(iii) upto 20% saving	13% of the earning
(iv) upto 30% saving	21% of the earning
(v) upto 40% saving	28% of the earning
(vi) above 40% saving	32% of the earning

The wage rates per hour of 4 workers—*P*, *Q*, *R* and *S* are respectively Re. 1.00, Rs. 1.10, 1.20 and 1.40. Overhead is recovered on direct wages at the rate of 200%. Standard cost under wages and overhead per unit of production is fixed at Rs. 30. The workers have completed one unit each in 8, 7, 5½ and 5 hours respectively. Calculate in respect of each worker :

(a) Amount of bonus earned.

(b) Total earnings.

(c) Total earnings per hour.

(I.C.W.A. Inter, June 1984)

Solution.

		<i>Q</i>	<i>R</i>	<i>S</i>
1. Time taken (hrs.)	8	7	5½	5
2. Rate per hour (Rs.)	1.00	1.10	1.20	1.40
3. Wages payable (Rs.)	8.00	7.70	6.60	7.00
4. Overhead (200% of wage) (Rs.)	16.00	15.40	13.20	14.00
5. Total cost	24.00	23.10	19.80	21.00
6. Standard cost	30.00	30.00	30.00	30.00
7. Cost savings	6.00	6.90	10.20	9.00
8. % Reduction on standard cost	20%	23%	34%	30%
9. Bonus entitlement (in terms of %)	13%	21%	28%	21%
(a) Bonus earned (col. 3 × % at col. 9) (Rs.)	1.04	1.62	1.85	1.47
(b) Total Earnings (Wages + Bonus)	9.04	9.32	8.45	8.47
(c) Total earnings per hour (Rs.)	1.13	1.33	1.54	1.694

LABOUR TURNOVER

Profit foregone due to labour turnover

Problem 2.16. The management of In and Out Ltd. are worried about their increasing labour turnover in the factory and before analysing the causes and taking remedial steps, they want to have an idea of the profit foregone as a result of labour turnover in the last year.

Last year sales amounted to Rs. 83,03,300 and the P/V ratio was 20 per cent. The total number of actual hours worked by the Direct Labour force was 4.45 lakhs. As a result of the delays by the Personnel Department in filling vacancies due to labour turnover, 1,00,000 potentially productive hours were lost. The actual direct labour hours included 30,000 hours attributable to training new recruits, out of which half of the hours were unproductive.

The costs incurred consequent on labour turnover revealed on analysis the following :

Settlement cost due to leaving	Rs. 43,820
Recruitment costs	26,740
Selection costs	12,750
Training costs	30,490

Assuming that the potential production lost as a consequence of Labour Turnover could have been sold at prevailing prices, find the profit foregone last year on account of labour turnover. (C.A. Inter. Nov., 1986)

Solution. (i) Determination of contribution foregone

Actual hours worked (Given)	4,45,000
Less : Unproductive training hours	15,000
Actual productive hours	<u>4,30,000</u>

The hours lost are 1,00,000.

$$\text{Sales lost for 1,00,000 hrs.} = \frac{\text{Rs. } 83,03,300}{4,30,000 \text{ hrs.}} \times 1,00,000 \text{ hrs.}$$

$$= \text{Rs. } 19,31,000$$

Contribution lost for 1,00,000 hrs.

$$= \frac{\text{Rs. } 19,31,000 \times 20}{100} = \text{Rs. } 3,86,200.$$

(ii) Statement showing profit foregone last year on account of labour turnover of In and Out Ltd.

Contribution foregone as per (i)	Rs. 3,86,200
Settlement cost due to leaving	43,820
Recruitment Cost	26,740
Selection Cost	12,750
Training Costs	30,490
	<hr/>
Profit foregone	5,00,000

Profit foregone on account of labour turnover

Problem 2:17. The Managing Director of All Found Limited is very much perturbed to see that labour turnover is increasing every year. Before taking appropriate action, he desires to know the profit foregone on account of Labour Turnover. You are required to calculate the profit foregone on account of labour turnover from the following.

ALL FOUND LTD.**Income Statement for the year ended 31-12-83**

Sales		Rs. 2,00,000
Variable cost :	Rs.	
Material	50,000	
Direct Labour	40,000	
Variable overhead	40,000	
	<hr/>	1,30,000
Contribution		70,000
Less : Fixed Overhead		20,000
		<hr/>
Profit before tax		50,000

The Direct Labour hours worked in the concern during the period were 20,300 of which 500 hours pertained to the new workers on training. Only 60% of the trainees' time was productive. As replacement for the worker left was delayed for some time, 600 productive hours were lost.

The direct costs incurred by the Company as a consequence of labour separation and replacements were as follows :

Separation costs—Rs. 2,000. Selection costs—Rs. 3,000 and Training costs—Rs. 5,000. (I.C.W.A. Final June, 1984)

Solution.

Direct labour hours worked	20,300
Less unproductive time of new workers (500 hrs. \times 60%)	300
	<hr/>
Productive hours	20,000

Lost labour hours 600 (Replacement) + 300 (Training) = 900

Unit sales per Productive Labour Hours Rs.

$$2,00,000 \div 20,000 = \text{Rs. } 10$$

(i)	Loss of potential sales 900 hrs. \times Rs. 10	= Rs. 9,000
	Direct labour cost per hour worked = Rs. $40,000 \div 20,300$	Rs. 1.97
(ii)	Increase in Direct labour cost of lost hours due to replacement = 600×1.97	Rs 1,182
	(300 hours already included while calculating the hourly rate)	
(iii)	Increase in material and variable overhead due to increase in potential sales = $\frac{90,000}{2,00,000} \times 9,000$	= Rs. 4,050
	Total increase in cost (ii + iii)	5,232
	Contribution foregone (i - iii)	3,768
	Add : Separation, selection and training costs	10,000
	Profit forgone due to labour turnover	13,768
		== ==

Profit lost due to labour turnover and computation of labour turnover ratio

Problem 2-18. The Alpha Corporation has filed the following income statement for the year ending 31st March, 1988.

Sales		Rs. 24,00,000
Less : Variable costs :		
Material	Rs 6,01,000	
Direct labour	5,19,000	
Variable factory overheads	3,20,000	
Variable selling and distribution O.H.	1,90,000	16,30,000
Contribution		7,70,000
Less : Fixed overheads		5,30,000
Net income before tax		2,40,000
Capital employed		12,00,000

The actual number of hours for direct labour worked in the year under review was 2,06,000. As a consequence of delays in filling vacancies of employees who quit, 6,000 potential direct hours were not worked and included in the actual hours worked were 4,000 hours of trainees, half of which time was unproductive. The costs incurred in consequence of re-employment were as follows :

- (a) Separation costs Rs. 25,630 ; (b) selection costs Rs. 32,080 ;
(c) recruitment costs Rs. 23,140 and (d) training costs Rs. 31,160.

Calculate the profits lost or forgone on account of labour turnover (round off to the nearest rupee) and the potential return on capital and sales and turnover ratio.
(I.C.W.A., Final)

Solution :

Cost of labour turnover can be broadly grouped under two categories

- (a) Preventive cost,
- (b) Replacement cost,

This particular question deals with the replacement cost only. Profit lost on account of labour turnover may be due to :

- (i) Savings in cost provided there was no labour turnover,
- (ii) Loss in contribution due to under-utilisation of capacity.

- (a) Saving in cost, if no replacement cost is incurred :

Separation costs	Rs. 25,630
Selection costs	32,080
Recruitment	23,140
Training	31,160
	<hr/>
Total Replacement costs	1,12,010
	<hr/>

(ii) Loss in Contribution :

$$\begin{aligned}
 \text{Actual effective direct labour hours} &= \text{Actual direct labour hours worked} - \text{trainees' unproductive hours.} \\
 &= 2,05,000 - \left(4,000 \times \frac{50}{100} \right) = 2,04,000 \text{ hrs.} \\
 \text{Potential effective labour hours} &= \text{Actual direct labour hours worked} + \text{potential direct hours not worked} \\
 &= 2,06,000 + 6,000 = 2,12,000 \text{ hrs.} \\
 \text{Effective labour hours lost} &= \text{Potential effective labour hours} - \text{Actual effective labour hours} \\
 &= 2,12,000 - 2,04,000 = 8,000 \text{ hours} \\
 \text{or} &= \frac{8,000}{2,04,000} \times 100 = 3.9216\%
 \end{aligned}$$

Had there been no loss of effective hours, production and sales would have gone up by 3.9216%.

The following losses can now be worked out

- (a) *Loss in contribution* = Rs. 7,70,000 \times 3.9216%
= Rs. 30,196.
- (b) *Total profit lost* = Loss in saving + loss in contribution
= 1,12,010 + 30,196
= Rs. 1,42,206.
- (c) *Potential profit* = Net profit before tax + Profit forgone at (b)
= 2,40,000 + 1,42,206
= Rs. 3,82,206.

$$\begin{aligned}
 (d) \text{ Potential sales} &= \text{Existing sales} + \text{sales lost} \\
 &= 24,00,000 + (24,00,000 \times 3.9216\%) \\
 &= 24,00,000 + 94,118 \\
 &= \text{Rs. } 24,94,118.
 \end{aligned}$$

$$\begin{aligned}
 (e) \text{ Potential on capital invested} &= \frac{\text{Potential profit}}{\text{Capital invested}} \\
 &= \frac{3,82,206}{12,00,000} \times 100 \\
 &= 31.851\%.
 \end{aligned}$$

$$\begin{aligned}
 (f) \text{ Potential return on sales} &= \frac{\text{Potential profit}}{\text{Potential sales}} \times 100 \\
 &= \frac{3,82,206}{24,94,118} \times 100 \\
 &= 15.324\%.
 \end{aligned}$$

$$\begin{aligned}
 (g) \text{ Turnover ratio} &= \frac{\text{Labour hours lost}}{\text{Potential labour hours}} \times 100 \\
 &= \frac{8,000}{2,12,000} \times 100 \\
 &= 3.774\%.
 \end{aligned}$$

MISCELLANEOUS

Cost of labour strike

Problem 2-19. (a) Distinguish between Idle Time, Absentecism and Strike. How are they treated in Cost Accounts ?

(b) Hithard Ltd. recently had a strike in one of its departments. By comparing budget and actual quantities for the period of the strike, the following estimate of the cost of the strike has been prepared :

Sales—Number of units below Budget		35,000
Budgeted unit Selling Price		Rs. 1.25
Total Revenue lost because of strike		43,750
Less : Cost Savings :		
Materials not used (35,000) units	8,750	
Wages saved (35,000 units)	17,500	26,250
		<hr/>
		17,500
Add : Wages paid during strike :		
Supervisory Staff	500	
Workers in Trade Unions unaffected by strike	1,000	
		<hr/>
		1,500
Fixed Overhead not recovered (35,000 units × Budgeted Overhead recovery rate)		8,750
		<hr/>
		27,750
		<hr/>

The Department produces only one product and keeps no stocks. At the time of the strike there was a temporary decline in demand for the product and it is estimated that actual sales would in any case have been 10,000 units below budget. The Sales Manager has said that even to reach this volume of sales, he would have to reduce the price of the last 25,000 units sold to Re. 1.

The workers who came in during the strike were used in maintenance work usually undertaken by an outside contractor for Rs. 3,000. Materials costing Rs. 1,000 had to be specially bought for the maintenance work. The budgeted fixed overhead rate is based solely on fixed costs that are unaffected by the activity of any one department. The company works on a five-day week Monday to Friday. It was agreed as a part of the strike settlement to make up 10,000 of the units lost because of the strike by working on Saturdays at a special wage rate which will add 25% to budgeted unit labour costs.

Taking all this information into account, send a note to the Managing Director, explaining in detail, with figures, what according to you should be the cost of the strike. (C.A. Final, Nov., 1983)

Solution. (a) Please refer to *Advanced Cost and Management Accounting—Text by Saxena and Vashist*.

(b) Note to the Managing Director detailing the cost impact of strike.

The company had a strike in one of its departments. It should be noted that the entire factory comprising a number of departments was not affected by the strike. The expected drop in sales was 35,000 units but the actual drop turned out to be 10,000 units. Therefore, sales lost during strike period were only 25,000 units at a selling price of Re. 1 (and not Rs. 1.25). The variable cost is as under :

(a) Contribution lost for 25,000 units

Materials Rs. $8,750 \div 35,000$ units = Re. 0.25

Wages Rs. $17,500 \div 35,000$ units = Re. 0.50

Total Variable cost per unit = Re. 0.75

Contribution per unit = Re. $1 - 0.75 = 0.25$

Contribution lost on 25,000 units = $25,000 \times 0.25 =$ Rs. 6,250.

(b) Savings on account of workers utilized for maintenance work

	Rs.
Materials purchased for maintenance	1,000
Wages paid during strike	1,500
Less : Savings from maintenance contract	(3,000)
Net Savings	(500)

(c) Additional cost for production of 10,000 units on Saturdays

✓ Actual wage rate per unit	Rs. 0.50
Add 25% extra	0.125
	<hr/>
	0.625
	<hr/>
Original contribution	= Rs. 0.25
Less : For extra wages	(-) 0.125
	<hr/>
Revised contribution	0.125
Total contribution to be made good by producing 10,000 units	
10,000 × 0.125	= Rs. 1,250.

Impact of strike on cost

Loss of contribution due to strike	Rs. 6,250
Less : Savings on account of maintenance	(500)
Less : Contribution to be made good	(1,250)
	<hr/>
Net cost of strike	4,500
	<hr/>

Note. Fixed overheads will not affect the cost as only one department of a factory is on strike. This is committed cost and is not relevant to the decision.

Problem 2-20 (Manpower forecasting) Manpower planning is an important exercise in personnel policy of any company. From the following details, calculate the estimated recruitment requirement of company over the next two years. The company has 1,000 staff in clerical grade I, the lowest clerical grade in the company, with the following age structure :

Under 20	600
20—30	300
Over 30	100
	<hr/>
	1,000
	<hr/>

Wastage rates and promotion prospects in the next two years are expected to be :

Age	Wastage	Promotion to next higher grade
Under 20	30%	10%
20—30	10%	40%
Over 30	5%	20%

The demand forecast shows that 1,200 clerical grade I staff will be required in two years time. Assume that no promotion will be made from lower grade to clerical grade I. (I.C.W.A. Final, December 1987)

Solution.	Man power in the beginning	1,000
(A) Wastages :		
(i) 30% of 600 = 180		
(ii) 10% of 300 = 30		
(iii) 5% of 100 = 5		(215)
		<hr/>
(B) Promotions		
(i) 10% of 600 = 60		
(ii) 40% of 300 = 120		
20% of 100 = 20		(200)
		<hr/>
Staff requirement		585
		<hr/>
		1,200
		<hr/>
Estimated recruitment over 2 years		615

Authors' Special Notes

1. This chapter is primarily relevant to "Intermediate level".
2. Direct questions are not asked at final level. Note—(i) Problem 2-2—determination of cost of repair job (ii) Problem P 2-18 and 2-19—impact on profit due to (a) labour turnover and (b) strike and (iii) 2-20 Manpower forecasting

BREAK-UP OF THE PROBLEMS RELATING TO LABOUR ACCORDING TO DIFFERENT LEVELS (FOR PROBLEMS WITH PREFIX A, REFER TO APPENDIX A)

Intermediate Level

Labour Cost—P 2-1

Remuneration and Incentives—P 2-3, 2-4, 2-5, 2-6, 2-7, 2-8, 2-9, 2-10, 2-11, 2-12, 2-13, 2-14, 2-15, A 25, A 76, A 113, A 152, A 162

Labour Turnover—P 2-16, A 42

Final Level

Labour Cost—P 2·2

Labour Turnover—P 2·17, 2·18

Miscellaneous—P 2·19, 2·20, A 38, A 57

Please also refer to the Examples 3·1 to 3·18 of the book "Advanced Cost and Management Accounting—Text" by Saxena and Vashist.

Overhead

[Departmentalisation of overhead 3'1--3'7 ; Computation of overhead rates 3'8--3'21 Underlover absorbed overheads 3'22--3'26 ; Effect of overhead on profit 3'27 ; Miscellaneous 3'28--3'35]

DEPARTMENTALISATION OF OVERHEAD

Apportionment of overheads to production and service departments

Problem 31. Selfhelp Ltd. has genset and produces its own power. Data for power costs are as follows :

Horse Power Hours	Production Depts.		Service Depts.	
	A	B	X	Y
Needed capacity production	10,000	20,000	12,000	8,000
Used during the month of May	8,000	13,000	7,000	6,000

During the month of May costs for generating power amounted to Rs. 9,300. Of this Rs. 2,500 was considered to be fixed cost. Service Depts. X renders service to A, B and Y in the ratio of 13 : 6 : 1 while Y renders service to A and B in the ratio of 31 : 3. Given that direct labour hours in Depts. A and B are 1,650 hours and 2,175 hours respectively, find the power cost per labour hour in each of these two Depts.

(C.A., Inter. Nov., 1985 ; C.A. Inter, May, 1973)

Solution. Statement showing the overhead distribution.

Particulars	Basis	Total	Production Depts.		Service Depts.	
			A	B	X	Y
		Rs.	Rs.	Rs.	Rs.	Rs.
Fixed Cost	H.P. Hrs. at needed cap. (5 : 10 : 6 : 4)	2,500	500	1,000	600	400
Variable Cost	H.P. Hrs. used (8 : 13 : 7 : 6)	6,800	1,600	2,600	1,400	1,200
Total Cost		9,300	2,100	3,600	2,000	1,600

Redistribution of Service Deptts. expenses to Production Departments

Particulars	Total	Production Deptts. Service Deptts.			
		A	B	X	Y
	Rs.	Rs.	Rs.	Rs.	Rs.
Total overheads	9,300	2,100	3,600	2,000	1,600
Deptt. X overheads apportioned to Deptts. A, B, and Y in the ratio of 13 : 6 : 1		1,300	600	(2,000)	100
Deptt. Y overhead apportioned to Deptts. A and B (31 : 3)		1,550	150		(1,700)
Total		4,950	4,350		
Total Direct Labour Hrs		1,650	2,175		
Power cost per labour hr.		3.00	2.00		

Apportionment of inter-service departmental overheads (Step and Reciprocal Methods)

Problem 32 The Space Production Company manufactures components for radio and television satellites using two service departments and two production departments. The inter-departmental relationships and estimate overhead costs are given below :

Percentage of Services Provided to

	Maintenance Scheduling Moulding Assembly			
From : Maintenance	—	10%	40%	50%
Scheduling	20%	—	50%	30%
Total overhead cost	Rs. 7,50,000	4,00,000	3,78,000	2,76,000

Required :

- Using the direct method, show the amount of Scheduling department costs to be allocated to Assembly department.
- Repeat (i) using the step method and allocating maintenance first.
- Repeat (i) using the reciprocal method (method of Simultaneous equations may be used). (*I.C.W.A., Inter, June, 1985*)

Solution. (i) *Direct Method* : Scheduling department costs to be allocated to Assembly department is 30% of Rs. 4,00,000 = Rs. 1,20,000.

(ii) *Step method.* (allocating maintenance cost first)

Particulars	Service Departments		Production Departments	
	Maintenance	Scheduling	Moulding	Assembly
Total overhead costs	Rs. 7,50,000	Rs. 4,00,000	Rs. 3,78,000	Rs. 2,76,000
Maintenance	(-) 7,50,000	75,000	3,00,000	3,75,000
Scheduling	95,000	(-) 4,75,000	2,37,500	1,42,500
Maintenance	(-) 95,000	9,500	38,000	47,500
Scheduling	1,900	(-) 9,500	4,750	2,850
Maintenance	(-) 1,900	190	760	950
Scheduling	38	(-) 190	95	57
Maintenance	(-) 38	4	15	19
Scheduling		(-) (4)	2	2
Total overheads	—	—	9,59,122	8,44,878

(iii) Let m be the overheads of maintenance.Let s be the overheads of scheduling.

$$m = 7,50,000 + 0.2s \quad \dots (i)$$

$$s = 4,00,000 + 0.1m \quad \dots (ii)$$

Rearranging (i) and (ii),

$$m - 0.2s = 7,50,000 \quad \dots (iii)$$

$$-0.1m + s = 4,00,000 \quad \dots (iv)$$

Multiply (iv) by 10

$$-m + 10s = 40,00,000 \quad \dots (v)$$

Adding equation (iii) and (v), we get

$$9.8s = 47,50,000 \quad \text{or} \quad s = 4,84,694$$

Putting the value of s in (i)

$$m = 7,50,000 + 0.2 \times 4,84,694 \quad \text{or} \quad m = 8,46,939$$

Allocation of overheads using reciprocal method (Rs.)

Particulars	Service Department		Production Department	
	Maintenance	Scheduling	Moulding	Assembly
Total overhead costs	7,50,000	4,00,000	3,78,000	2,76,000
Maintenance	(-) 8,46,939	84,694	3,38,775	4,23,470
Scheduling	96,939	(-) 4,84,694	2,42,347	1,45,408
		—	9,59,122	8,44,878

Apportionment of inter-service departmental overhead and finding overhead absorption rate

Problem 33. Superclass Co. Ltd. has three production departments X, Y and Z and two service departments A and B.

The following estimated figures for a certain period have been made available :—

Rent and Rates	Rs. 10,000
Lighting and Electricity	1,200
Indirect Wages	3,000
Power	3,000
Depreciation of Machinery	20,000
Other Expenses and Sundries	20,000

Following are further details which are also available :—

	Total	X	Y	Z	A	B
Floor Space (Sq. mts)	10,000	2,000	2,500	3,000	2,000	500
Light Points(Nos.)	120	20	30	40	20	10
Direct wages Rs.	20,000	6,000	4,000	6,000	3,000	1,000
Horsepower of machines	300	120	60	100	20	—
Cost of Machinery (Rs.)	1,00,000	24,000	32,000	40,000	2,000	2,000
Working hours	4,670	3020	3050	—	—	—

The expenses of the service departments A and B are to be allocated as follows :—

	X	Y	Z	A	B
A	20%	30%	40%	—	10%
B	40%	20%	30%	10%	—

You are required to calculate the overhead absorption rate per hour in respect of the three production departments.

What will be the total cost of an article with material cost of Rs. 80 and direct labour cost of Rs. 40 which passes through X, Y and Z for 2, 3 and 4 hours respectively ?
(I.C.W.A Inter, June 1985)

Solution : **Superclass Company Ltd.****Departmental Primary Distribution Summary**

Items	Basis of Apportionment	Total	Production Deptt.			Service Deptt.	
			X	Y	Z	A	B
1. Rent, Rates and Taxes	Floor Area	Rs. 10,000	Rs. 2000	Rs. 2500	Rs. 3000	Rs. 2000	Rs. 500
2. Lighting and Electricity	Light Point	1200	200	300	400	200	100
3. Indirect Wages	Direct Wages	3000	900	600	900	450	150
4. Power	Horse power of machines	3000	1200	600	1000	200	—
5. Depreciation of machinery	Cost of Machine	20,000	4800	6400	8000	400	400
6. Other expenses and sundries	D. wages	20000	6000	4000	6000	3000	1000
7. Direct wages	Only service Deptt.	4000	—	—	—	—	1000
		61000	15000	14400	19300	9250	3150

Secondary Distribution Summary

	X	Y	Z	A	B
A	1850	2775	3700	19250	925
B	1630	815	1222	208	(4075)
A	82	122	163	(408)	41
B	16	8	13	4	(41)
A	2	—	2	(4)	—
Sub-totals	3580	3720	5100		
Grand total	18680	18120	24400		
Working hours	X 4670	Y 3020	Z 3050		
Rate per hour (Rs.)	4	6	8		

Statement of cost per unit

Material cost	Rs. 80	Rs.
Labour	40	
Prime cost		120

Overhead.

X	2 × 4	8	
Y	3 × 6	18	
Z	4 × 8	32	
		<hr/>	58
Total productive cost			<hr/> 178 <hr/>

Apportionment of inter-service departmental overheads

Problem 3·4. A factory is having three production departments A, B and C, and two service departments Boiler-house and pump room. The boiler-house has to depend upon the pump-room for supply of water and pump room in its turn is dependent on the boiler-house for supply of steam power for driving the pump. The expenses incurred by the production departments during a period are : A—Rs. 8,00,000 ; B—Rs. 7,00,000 ; and C—Rs. 5,00,000. The expenses for boiler-house is Rs. 2,34,000 and the pump-room—Rs. 3,00,000.

The expenses of the boiler-house and pump-room are apportioned to the production departments on the following basis :

	A	B	C	B.H.	P.R
Expenses of boiler-house	20%	40%	30%	—	10%
Expenses of pump-room	40%	20%	20%	20%	—

Show clearly as to how the expenses of boiler-house and pump-room would be apportioned to A, B and C departments. Use algebraical equation. (C.S. Final June, 1984, C.S. Inter June 1988)

Solution. Let B be the total overhead of Boiler-house

P be the total overhead of Pump-house

$$B = \text{Rs. } 2,34,000 + 0.2P \quad \dots(i)$$

$$P = \text{Rs. } 3,00,000 + 0.1B \quad \dots(ii)$$

Multiply both equations by 10

$$10B = 23,40,000 + 2P \quad \dots(iii)$$

$$10P = 30,00,000 + 1B \quad \dots(iv)$$

Multiply (iii) by 5

$$50B = 117,00,000 + 10P$$

$$\text{or } -10P + 50B = 1,17,00,000 \quad \dots(v)$$

$$10P - 1B = 30,00,000 \quad \dots(vi)$$

$$\text{Adding } 49B = 1,47,00,000$$

or B (Total overheads for Boiler House) = Rs. 3,00,000

Putting the value B in (iv)

$$10P = 30,00,000 + 3,00,000$$

$$\text{or } P = \text{Rs. } 3,30,000 \text{ (Total overhead for Pump-house)}$$

Total overheads, thus arrived at, can be apportioned to production departments on the basis of agreed percentages.

Simultaneous Equation Method

	<i>Total</i>	<i>Production Departments</i>			<i>Service Dept.</i>	
		<i>A</i>	<i>B</i>	<i>C</i>	<i>B.H.</i>	<i>P.R.</i>
As given (Rs)	25,34,000	8,00,000	7,00,000	5,00,000	2,34,000	3,00,000
B.H.		60,000	1,20,000	90,000	(3,00,000)	30,000
P.R.		1,32,000	66,000	66,000	66,000	(3,30,000)
Total overheads	25,34,000	9,92,000	8,86,000	6,56,000	(Nil)	(Nil)

Apportionment of inter-service departmental overheads

Problem 3.5. Modern Manufacturers Ltd. have three Production Departments P_1 , P_2 , P_3 and two Service Departments S_1 and S_2 , the details pertaining to which are as under :—

	P_1	P_2	P_3	S_1	S_2
Direct Wages (Rs.)	3,000	2,000	3,000	1,500	195*
Working Hours	3,070	4,475	2,419	—	—
Value of Machines (Rs.)	60,000	80,000	1,00,000	5,000	5,000
H.P. of Machines	60	30	50	10	—
Light Points	10	15	20	10	5
Floor Space (sq. ft.)	2,000	2,500	3,000	2,000	500

The following figures extracted from the accounting records are relevant :—

Rent and Rates	Rs. 5,000
General Lighting	600
Indirect Wages	1,939
Power	1,500
Depreciation on Machines	10,000
Sundries	9,695

The expenses of the Service Departments are allocated as under :—

	P_1	P_2	P_3	S_1	S_2
S_1	20%	30%	40%	—	10%
S_2	40%	20%	30%	10%	—

Find out the total cost of product X which is processed for manufacture in Department P_1 , P_2 and P_3 for 4, 5 and 3 hours respectively, given that its Direct Material Cost is Rs. 50 and Direct Labour Cost Rs. 30.

(C.A. Inter. Nov. 1984)

Solution. Statement showing distribution of overheads of Modern Manufactures Ltd.

Particulars	Basis	Total	Production Deptts.			Service Deptts.	
			P ₁	P ₂	P ₃	S ₁	S ₂
Rent	Area	5000	1000	1250	1500	1000	250
General Lighting	Light points	600	100	150	200	100	50
Indirect Wages	D. wages	1939	600	400	600	300	39
Power	H.P.	1500	600	300	500	100	—
Depreciation on Machines	Value of Mach.	10,000	2400	3200	4000	200	200
Sundries	Direct Wages	9695	3000	2000	3000	1500	195
		28734	7700	7300	9800	3200	734

Redistribution of Service Departments expenses over production department.

	P ₁	P ₂	P ₃	S ₁	S ₂
Total Overhead	7700	7300	9800	3200	734
Overheads of Deptt. S ₁ (20 : 30 : 40 : — : 10)	640	960	1280	—	320
Overhead of Deptt. S ₂ (40 : 20 : 30 : 10 : — :)	421·60	210·80	316·20	105·40 (—)	1054
Overheads of Deptt. S ₁ (20 : 30 : 40 : — : 10)	21·08	31·62	42·16 (—)	105·40	10·54
Overheads of Deptt. S ₂ (40 : 20 : 30 : 10 : — :)	4·22	2·11	3·16	1·05 (—)	10·54
Overheads of Deptt. S ₁ (20 : 30 : 40 : — : 10)	0·21	0·32	0·42 (—)	1·05	0·10
Overheads of Deptt. S ₂ (40 : 20 : 30 : 10 : — :)	0·05	0·02	0·03	— (—)	0·10
Total	8787·16	8504·87	11441·97	—	—
Working hours	3070	4475	2419	—	—
Working rate per hour	2·86	1·90	4·73	—	—
(Total cost ÷ working hrs.)					

Statement showing Cost of Product X

Direct material	Rs. 30·00
Direct Labour	50·00
Production overhead	
Deptt. P ₁ (4 hrs. × Rs. 2·86)	11·44
Deptt. P ₂ (5 hrs. × Rs. 1·90)	9·50
Deptt. P ₃ (3 hrs. × Rs. 4·73)	14·19
	<u>35·13</u>
Total Cost	<u>115·13</u>

COMPUTATION OF OVERHEAD RATES**Schedule of overhead recovery rates**

Problem 3'6. From the records of a manufacturing company, the following budgeted details are available :

Direct Materials	Rs.	Rs. 1,99,000
Direct Wages :		
Machine shop (12000 hours)	63,000	
Assembly shop (10000 hours)	48,000	1,11,000
		<hr/>
Works Overhead .		
Machine Shop	88,200	
Assembly Shop	51,800	1,40,000
		<hr/>
Administration Overhead		90,000
Selling Overhead		81,000
Distribution Overhead		62,100

Assuming that the company follows absorption method of costing, you are required to :

(a) Prepare a Schedule of Overhead rates from the figures available stating the basis of overhead recovery rates used under the given circumstances.

(b) Work out a Cost Estimate for the following job based on Overhead so computed.

Direct Material :	25 kg @ Rs. 16'80/kg.
	15 kg @ Rs. 20'00/kg.
Direct Labour :	Machine Shop 30 hours
(on the basis of hourly rate for Machine Shop & Assembly Shop).	Assembly Shop 42 hours
	(I.C.W.A. Inter, June, 1937)

Solution (a) Schedule showing overheads rates

Raw Materials	Rs.	Rs. 1,99,000
Direct wages :		
Machine shop (12,000 hrs. @ Rs. 5'25 p.h.) @	63,000	
Assembly shop (10,000 hrs. Rs. 4'80 p.h.)	48,000	1,11,000
		<hr/>
Prime cost		3,10,000

Works overheads :

Machine shop (140% of D. Wages)	88,200	
Assembly shop (107.92% of D. Wages)	51,800	
	<hr/>	1,40,000
Works cost		4,50,000
Administration Overhead (20% of works cost)		90,000
		<hr/>
Cost of production		5,40,000
Selling and distribution overheads (26.5% of cost of production)		1,43,100
		<hr/>
Cost of Sales		6.83,100
		<hr/>

(b) Statement showing cost estimates for the job

Direct Materials	25 kg. \times Rs. 16.80 = 420	
	15 kg. \times Rs. 20.00 = 300	
	<hr/>	Rs. 720.00

Direct wages :

Machine shop	30 hrs. \times Rs. 5.25 = 157.50	
Assembly shop	42 hrs. \times Rs. 4.80 = 201.60	
	<hr/>	359.10
Prime cost		1079.10

Works overheads

Machine shop—140% of direct wages	= 220.50	
Assembly shop—107.92% of direct wages	= 217.57	
	<hr/>	438.07
Works cost		1517.17
Administrative overheads (20% of works cost)		303.43
		<hr/>
Cost of production		1820.60
Selling and distribution overhead (26.5% of cost of production)		482.46
		<hr/>
Cost of Sales		2303.06
		<hr/>

Departmental vs. Plantwise Overhead Rates

Problem 3.7. The Pipe Company manufacture two products, A and B during the first year of its operations. For purposes of product costing, an overhead rate of application of Rs. 1.70 per direct-labour hour was used, based on budgeted factory overhead of Rs. 3,40,000 and budgeted direct-labour hours of 2,00,000 as follows.

	Budgeted overhead Rs.	Budgeted hours
Department 1	2,40,000	1,00,000
Department 2	1,00,000	1,00,000
Total	3,40,000	2,00,000

The number of labour hours required to manufacture each of these products was :

	Product A	Product B
In Dept. 1	4	1
In Dept. 2	1	4
	<u>5</u>	<u>5</u>

At the end of the year, there was no work in process. There were, however, 2,000 and 6,000 Finished Units, respectively, of products A and B on hand. Assume that budgeted activity was attained.

(a) What was the effect on the Company's income of using a plantwise overhead rate instead of departmental overhead rates ?

(b) Assume that material and labour costs per unit of Product A were Rs. 10/- and that the selling price was established by adding 40 per cent to cover profit and selling and administrative expenses. What difference in selling price would result from the use of departmental against plantwise overhead rates ?

(c) Explain why departmental overhead rates were generally preferable to plantwise rates.

(ICWA, Inter, December, 1985)

Solution (a) Plantwise overhead rate and departmental overhead rates.

Overhead rates :

Department 1 = Rs. $2,40,000 \div 1,00,000$ = Rs. 2·40 per D.L.H.

Department 2 = Rs. $1,00,000 \div 1,00,000$ = Re. 1·00 per D.L.H.

	Product A	Product B
(i) Plantwise overhead	$5 \times 1·70$ = Rs. 8·50	$5 \times 1·70$ = Rs. 8·50

(ii) Departmental overhead :

Dept. 1	$4 \times 2·40$ = 9·60	$1 \times 2·40$ = 2·40
Dept. 2	$1 \times 1·00$ = 1·00	$4 \times 1·00$ = 4·00
	<u>10·60</u>	<u>6·40</u>

(iii) Difference between the two (i—ii) (—) 2·10 (—) 2·10

(iv) Difference on finished units

$2000 \times (-) 2·10 = (4,200)$ $6000 \times 2·10 = 12,600$

Overall difference $12600 - 4200$

= + 8400

Effect on the Company. By using plantwise overhead rate, the closing stock of Product A was undervalued to the extent of Rs. 4,200 and closing stock of Product B was overvalued to the extent of Rs. 12,600. The overall overvaluation of these products comes to Rs. 8,400. In other words, the company's income was overstated by Rs. 8,400.

		Product A
(i)	Material and and labour cost	Rs. 10.00 per unit 10.00
	Plantwise overheads	8.50
	Work cost	18.50
	Add: 40% to cover profit, selling and admn exp.	7.40
	Selling price	25.90
(ii)	Materials and labour cost	10.00
	Departmental overheads	10.60
	Work cost	20.60
	Add: 40% to cover profit, selling and admn. exp.	8.24
	Selling price	28.84
	Difference (ii—i)	2.94

(c) Please refer to *Advanced Cost and Management Accounting*—Text by Saxena and Vashist.

Comprehensive Machine Hour Rate

Problem 3.8. A machine shop has 8 identical Drilling Machines manned by 6 operators. The machines cannot be worked without an operator wholly engaged on it. The original cost of all these 8 machines works out to Rs. 8 lakhs. These particulars are furnished for a six-month period :—

Normal available hours per month	208
Absentecism (without pay)—hours	18
Leave (with pay)—hours	20
Normal idle time unavoidable—hours	10
Average rate of wages per day of 8 hours	Rs. 20
Production Bonus estimated	15% on wages
Value of Power consumed	Rs. 8,050
Supervision and Indirect Labour	Rs. 3,300
Lighting and Electricity	Rs. 1,200

These particulars are for a year :

Repairs and maintenance including consumables 3% on value of machines.

Insurance Rs. 40,000.

Depreciation 10% on original cost.

Other Sundry works expenses Rs. 12,000.

General Management expenses allocated Rs. 54,530.

You are required to work out a comprehensive machine hour rate for the Machine Shop. (C.A. Inter, Nov. 1986)

Solution. Before computing the comprehensive machine hour rate, it is necessary to find out the total machine hours utilized and total wages paid to operators.

Computation of total machine hours utilized

Normal available hours p.m. per operator 208 Hours

Less : Unutilized hours due to :

Absenteeism	18 Hours	
Leave	20	
Idle time	10	48
		<hr/>

Total hours utilized p.m. per operator 160

Total hours utilized for 6 months for 6 operators

= $160 \times 6 \times 6$ or 5,760 hrs.

It is given in the question that the machines cannot work without an operator wholly engaged on it. Therefore, hours utilized for 6 operators, i.e., 5,760 hrs. represents the total machine hours.

Total wages to 6 operators for 6 months

Average rate of wages per hour = Rs. $20 \div 8$ hrs = Rs. 2·50

Normal hours for which wages

are to be paid = $208 - 18$ or 190 hrs.

Wages for 6 months for 6 operators @ Rs. 2·50/hr.

= $190 \times 6 \times 6 \times 2·50$ or Rs. 17,100.

Computation of Comprehensive Machine hour rate for the Machine Shop

Operators' wages (as above)	Rs. 17,100
Production Bonus (15% of wages)	2,565
Power consumed	8,050
Supervision and indirect labour	3,300
Lighting and electricity	1,200
Repairs and Maint. (3% of Rs. 8 lakhs) $\div 2$	12,000
Insurance (given for 12 months ; reduced to 50% for 6 months)	20,000
Depreciation for 6 months	40,000
Other sundry works expenses for 6 months	6,000
General management expenses for 6 months	27,265
	<hr/>
Total overheads for 6 months	1,37,480

Comprehensive Machine Hour Rate = $1,37,480 \div 5760$ hrs.
= Rs. 23·87 per hr.

Computation of Machine Hour Rate

Problem 3-9. Prepare a machine hour rate computation for the month of Dec., 1981 to cover the overhead expenses indicated below, relating to a particular machine :—

	Per annum Rs.
Rent of department (space occupied by machine- 1/5th of the Dept.)	780
Lighting of Dept.	240
Insurance etc.	36
Cotton Waste, Oil etc.	60
Salary of Foreman (1/4th of Foreman's time is occupied by this machine and the remainder equally upon two other machines)	6,000

The cost of the machine is Rs. 9,200 and it has an estimated scrap value of Rs. 200.

It is assumed from past experience :—

- (a) that the machine will work for 1,800 hrs. p.a. ,
- (b) that it will incur an expenditure of Rs. 1,000 for repairs and maintenance ;
- (c) that it consumes 5 units of power per hour at a cost of 10 paise per unit ; and
- (d) that the working life of the machine will be 10 years.

(CS Final, June 1982)

Solution. Statement showing the Machine Hour Rate
(Machine Hours 1800 Hrs. p.a.)

Particulars	Basis of apportionment	Amount per annum	Machine Hour Rate
Fixed charges			
Rent	Rs. $780 \div 5$	Rs. 156	
Lighting	$240 \div 5$	48	
Insurance		36	
Cotton waste, oil etc.		60	
Salary of Foremen	$6,000 \div 4$	1,500	
Depreciation	$(9200 - 200 \div 10)$	900	
		<u>$2,700 \div 1800 =$</u>	<u>Rs. 1.50</u>
Variable charges			
Repairs and maintenance (assumed variable)	$1,000 \div 1,800$		0.56
Power	$5 \times \text{Rs. } 0.10$		0.50
Total variable			<u>1.06</u>
Machine Hour Rate (Fixed + Variable)			<u><u>2.56</u></u>

Computation of Machine Hour Rate**Problem 3'10.** The following particulars relate to a machine :

Purchase price of machine	Rs. 80,000
Installation expenses	20,000
Rate per quarter	3,000
General lighting for the total area	200 per month
Supervisor's salary	6,000 per quarter
Insurance premium for the machine	600 per annum for the machine
Estimated repair for the machine	1,000 —do—
Estimated consumable stores	800 —do—
Power 2 units per hour @ Rs. 50 per 100 units	

The estimated life of machine is 10 years and the estimated scrap value is Rs. 20,000. The machine is expected to run 20,000 hrs. in its life time. The machine occupies 25% of the total area. The supervisor devotes 1/6th of his time for the machine. You are required to work out machine hour rate. (CS Final June 83)

Solution. Statement showing the Machine Hour Rate
Running hours 20,000 ÷ 10 = 2,000 hrs. p.a.

Particulars	Basis of apportionment	Amount per annum	Machine Hour Rate
Fixed Costs			
Depreciation	$\frac{80,000 - 20,000}{10}$	Rs. 8,000	
Rent	$3000 \times 4 \text{ Qrs.} \times 25\%$	3,000	
General Lighting	$200 \times 12 \times 25\%$	600	
Supervisor's salaries	$6000 \times 4 \times \frac{1}{6}$	4,000	
Insurance		600	
Repairs		1,000	
Consumable stores		800	
Total		18,000 ÷ 2000	Rs. 9'00
Variable Cost			
Power	$2 \times 0'50$		1'00
Machine Hour Rate			10'00
			====

Computation of Suitable absorption rates

Problem 3'11. For a factory, which has three production departments (two machine shops and one assembly shop) and three service departments, one of which—engineering, Service Department, serving the machine shops only, you are required to :

(a) Prepare an overhead analysis sheet, showing the bases of any apportionment of overhead to departments ;

(b) Calculate suitable overhead absorption rates for the production departments, ignoring the apportionment of service department costs amongst service departments ;

(c) Calculate the overheads to be absorbed by two products, X and Y, whose cost sheet shows the following times spent in different departments :

	X	Y
Machine shop : A	5 machine hrs.	3 machines hrs.
Machine shop : B	2 machine hrs.	7 machine hrs.
Assembly shop	7 direct labour hrs.	9 direct labour hrs.

The annual budgeted overhead costs for the year are :

	Indirect wages (Rs.)	Consumable supplies (Rs.)
Machine shop A	23,260	6,300
Machine shop B	20,670	9,100
Assembly shop	8,110	2,100
Stores	4,100	1,400
Engg. services	2,670	2,100
General services	3,760	1,600
Depreciation of machinery	22,000	
Insurance of machinery	4,000	
Insurance of building	1,800 (See note 1)	
Power	3,600	
Light and heat	3,000	
Rent	7,050 (See note 2)	

Notes : 1. Because of special fire risks, machine shop A is responsible for a special loading of insurance on the building. This results in a total building insurance cost for machine shop A as one-third of the annual premium.

2. The general services department is located in a building owned by the company. It is valued at Rs. 6,000 and is charged into costs at a notional value of 8% per annum. This cost is additional to the rent and rates shown above.

3. The value of issues of materials to the production departments are in the same proportion as shown above for consumable supplies.

The following data are also available :

Departments	Book value of machinery (Rs.)	Area (sq. ft.)	Effective H.P. hours %	Production Direct Labour hours	Capacity Machine hours
Machine Shop : A	60,000	5,000	50	200,000	40,000
Machine Shop : B	45,000	6,000	33½	150,000	50,000
Assembly Shop	15,000	8,000	4½	300,000	—
Stores	6,000	2,000	—	—	—
Engg. Service	18,000	2,500	12½	—	—
General Service	6,000	1,500	—	—	—

Solution. (a) (i) Departmental Distribution Summary

Items of Expenditure	Basis of Apportionment	Total Amount	Production Deptt.						Service Department		
			M/c Shop A	M/c Shop B	Shop Assembly	Stores	Engg. Service	General Service			
		Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Indirect wages	Allocation given	62,570	23,260	20,670	8,110	4,100	2,670	3,760			
Con. Supplies	"	22,600	6,300	9,100	2,100	1,400	2,100	1,600			
Depreciation on Machine	Capital value of Machinery	22,000	8,800	6,600	2,200	880	2,640	880			
Insurance on Machinery	"	4,000	1,600	1,200	400	160	480	160			
Insurance on Building	1/3 rd to Machine Shop and Balance on area basis	1,800	600	360	480	120	150	90			
Power	H.P. Hrs. (%)	3,600	1,800	1,200	150	—	450	—			
Light and Heat	Area	3,000	600	720	960	240	300	180			
Rent and Rates	Area	7,050	1,500	1,800	2,400	600	750	—			
Rent of general Service	Direct to G/Service Deptt @ 8% on Rs. 6,000	480	—	—	—	—	—	480			
Total		1,27,100	44,460	41,650	16,800	7,500	9,540	7,150			

(ii)

Distribution of Service Depart- ment Costs	Basis of apportionment	Total Amount	Production Department			Service Department		
			Machine Shop		Assembly Shop	Stores	Engg.	General Service
			A	B				
		Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Stores	Ratio of Con. Supplies Value (63 : 91 : 21)		2,700	3,900	900	(7,500)	—	—
Engineering Service	Machine hours of Shops A & B only (4 : 5)		4,240	5,300	—	—	(9,540)	—
General Service	Labour hours (20 : 15 : 30)		2,200	1,650	3,300	—	—	(7,150)
			9,140	10,850	4,200			
			44,460	41,650	16,800			
Total allocated overhead as per (a) (ii) above								
Total allocated and apportioned overhead of Production Deptt.		1,27,100	53,600	52,500	21,000			

(b)

Overhead Absorption Rates

	<i>Production Departments</i>		
	<i>Machine Shop A</i>	<i>Machine Shop B</i>	<i>Assembly Shop</i>
Total overhead allocated is rupees [as per a (ii) above]	53,600	52,500	21,000
Machine Hours	40,000	50,000	
Labour hours			3,00,000
Rate per machine hour	Rs. 1.34	Rs. 1.05	
Rate per direct labour hour			Re. 0.07

(c) Statement showing amount of overheads absorbed by two products X and Y

<i>Shop</i>	<i>Absorption rate per hour</i> Rs.	<i>Product X</i>		<i>Product Y</i>	
		<i>Hrs.</i>	<i>Rs.</i>	<i>Hrs.</i>	<i>Rs.</i>
Machine Shop					
<i>A</i>	1.34	5	6.70	3	4.02
<i>B</i>	1.05	2	2.10	7	7.35
Assembly Shop	0.07	7	0.49	9	0.63
Total overhead absorbed by products			9.29		12.00

Note. Machine Shops *A* and *B* have got the production capacity of both direct labour hour and machine hours. It appears to reason that overhead absorption of machine shop *A* and *B* should be based on machine hours and absorption overhead rate of Assembly shop should be based on labour hours.

Computation of Machine Hour Rate with replacement by new machine

Problem 3-12. (a) The following data is available in respect of a machine :

Cost of Machine	Rs. 10,000
Estimated Scrap Value	Rs. 1,000
Working life of the machine	6 years.

The machine is discarded because of obsolescence after 4 years of service and sold for Rs. 2,000. What is the resultant loss and how would you treat the same in Cost Accounts ?

(b) From the following particulars, calculate the machine hour rate of a machine installed in a department :

Cost of Machine	Rs. 16,000
Estimated scrap value after expiry of its life (15 years)	Rs. 1,000

Estimated working hours of the machine, per year	2,000 hours.
Monthly salary of a Foreman engaged in supervision of this machine and another two identical machines	Rs. 1,500
Repairs and Maintenance for the machine	Rs. 2,400 per year
Insurance premium for the machine	Rs. 120 per year
Department rent and rates are Rs. 1,200 per year. The space occupied by the machine is 1/6th of the floor space of the department.	
Power consumption of the machine is 2 units per hour @ 10 paise per unit. (I.C.W.A. Inter, June 1986)	

Solution.

(a) Cost of machine	Rs. 10,000
Estimated Scrap value at the end of working life	Rs. 1,000
	<hr/>
Working life	Rs. 9,000
	6 years
Depreciation charge per year $(Rs. 9,000 \div 6)$	Rs. 1,500
Depreciation for 4 years $(Rs. 1,500 \times 4 \text{ years})$	Rs. 6,000
Written down value at the end of 4 years (Rs. 10,000 - Rs. 6,000)	Rs. 4,000
Sale Value	2,000
	<hr/>
The resultant loss on sale	2,000

Treatment—This loss is a normal loss and it should not be charged to production. This should be debited to Costing Profit and Loss Account. This can be done as follows:

- Entire loss can be debited to Costing Profit and Loss Account for current year.
- The loss may be spread over the two years and each year Rs. 1,000 should be debited to Costing Profit and Loss Account.

(b) Computation of machine hour rate

(Working period 2,000 hours per annum)

Particulars of the charges	Per year	Per hour
(a) Depreciation $(Rs. 16,000 - 1,000) \div 15$	1,000	0.50
(b) Salary of the foreman $Rs. 1,500 \div 12.5$	6,000	3.00
(c) Repairs and Maintenance for the machine	2,400	1.20
(d) Insurance Premium	120	0.06
(e) Rent and Rates $Rs. 1,200 \div 6$	200	0.10
	<hr/>	<hr/>
	9,720	4.86
(f) Power—direct charge $2 \text{ units} \times Rs. 0.10$		0.20
		<hr/>
Machine hour rate		5.06

Problem 3-13 (Machine Hour Rate) From the following data, work out the predetermined machine hour rates for departments A and B of a factory :

<i>Preliminary estimates of expenses</i>			
	<i>Total</i>	<i>Deptt A</i>	<i>Deptt B</i>
Power	Rs. 15,000	Rs. —	Rs. —
Spare parts	8,000	3,000	5,000
Consumable stores	5,000	2,000	3,000
Depreciation on machinery	30,000	10,000	20,000
Insurance on machinery	3,000	—	—
Indirect labour	40,000	—	—
Building maintenance	7,000	—	—

The final estimates are to be prepared on the basis of above figures after taking into consideration the following factors :

- An increase of 10 per cent in the price of spare parts.
- An increase of 20 per cent in the consumption of spare parts for department B only.
- Increase in the straight line method of depreciation from 10 per cent on the original value of machinery to 12 per cent
- 15 per cent general increase in wage rates.

<i>The following information is available :</i>		
	<i>Deptt A</i>	<i>Deptt B</i>
Estimated direct labour hours	80,000	1,20,000
Ratio of K.W. rating	3	2
Estimated machine hours	25,000	30,000
Floor space (sq. ft.)	15,000	20,000

(I.C.W.A. Inter, December, 1987)

Solution. Statement showing the Machine Hour Rate

<i>S. No.</i>	<i>Item</i>	<i>Basis of apportionment</i>	<i>Total</i>	<i>Deptt A</i>	<i>Deptt B</i>
1.	Power	K.W. Rating	Rs. 15,000	Rs. 9,000	Rs. 6,000
2.	Spare parts	Direct on final estimate	9,900 ¹	3,300	6,600
3.	Consumable stores	Direct	5,000	2,000	3,000
4.	Depr. on machinery	Direct on final estimate	36,000 ²	12,000	24,000
5.	Insurance on machinery	Depreciation Ratio*	3,000	1,000	2,000
6.	Indirect labour	Estimates D.L.H.	46,000 ³	18,400	27,600
7.	Building maintenance	Floor area	7,000	3,000	4,000
	Total		1,21,900	48,700	73,200
	Machine Hours			25,000	30,000
	Machine Hour Rate			Rs. 1.948	Rs. 2.440

*It is assumed that uniform depreciation rates on different types of machinery are applied. The best way to apportion depreciation would have been on the value of machinery.

Working Notes

(1) Spare Parts	Total	Deptt A	Deptt B
Preliminary estimates	Rs. 8,000	Rs. 3,000	Rs. 5,000
Add : Price increase @ 10%	800	300	500
Total	8,800	3,300	5,500
Increase in consumption in Deptt B @ 20%	1,100	—	1,100
Final estimates	9,900	3,300	6,600
(2) Depreciation	30,000	10,000	20,000
20% increase in the rate	6,000	2,000	4,000
Final estimate	36,000	12,000	24,000
(3) Indirect labour	40,000		
Add : 15% increase in wage rate	6,000		
Final estimates	46,000		

Computation of Machine Hour Rate with/without use of Computer

Problem 3'14. Gemini Enterprises undertakes three different jobs A, B and C. All of them require, the use of a special machine and also the use of a computer. The computer is hired and the hire charges work out to Rs. 4,20,000 per annum. The expenses regarding the machine are estimated as follows :

Rent for the quarter	Rs. 17,500
Depreciation per annum	2,00,000
Indirect charges per annum	1,50,000

During the first month of operation the following details were taken from the job register :

Job	A	B	C
Number of hours the Machine was used :			
(a) Without the use of the Computer	600	900	—
(b) With the use of the Computer	400	600	1,000

You are required to compute the machine hour rate :—

(a) For the firm as a whole for the month when the computer was used and when the computer was not used.

(b) For the individual jobs A, B and C. (C.A., Inter, May 1987)

Solution (a) Machine hour rate for the month when the computer was used and when the computer was not used.

Total machine hours without the use of computer	1,500
Total machine hours with the use of computer	2,000
Total machine hours	3,500
Total overheads of the machine per month (Rs. 17,500 ÷ 3)	Rs. 5,833.33
Depreciation (2,00,000 ÷ 12)	16,666.67
Indirect charges	12,500.00
Total overheads of the machine	35,000.00
Machine hour rate (overall)	Rs. 35000 ÷ 3500 = Rs. 10
Computer hire charges	420,000 ÷ 12 = Rs. 35,000
Overheads for using machine without computer 1500 hours × Rs. 10	= Rs. 15,000
Overheads for using machine with computer (2000 hours × Rs. 10) + Rs. 35000 i.e.,	= Rs. 55,000
Machine Hour Rate for the firm as a whole :	
when computer was not used =	Rs. 10
when computer was used (55000 ÷ 2000)	Rs. 27.50

(b) Machine hour rate for the individual jobs.

Details	Rate per hour	Job					
		A		B		C	
		Hrs.	Rs.	Hrs.	Rs.	Hrs.	Rs.
Without computer	Rs. 10.00	600	6000	900	9000		
With computer	27.50	400	11,000	600	16,500	1000	27,500
		1000	17,000	1500	25,500	1000	27,500
Machine hour rate for each job		Rs. 17.00		Rs. 17.00		Rs. 27.50	

Computation of overhead absorption rates

Problem 3-15. In a certain factory, three products are made from different materials by similar processes. For a typical period, production costs are as under :

	Product A	Product B	Product C
Material used	Rs. 1,600	Rs. 2,000	Rs. 800
Direct labour Cost	1,200	1,000	400
Overhead (actual)	800	650	350

Overhead is charged to cost of each product at the rate of 25% on prime cost.

Do you see anything wrong in principle in this method of charging overheads? If so, suggest a preferable method.

(I.C.W.A. Inter, June 1984)

Solution. Overhead is charged to each product at 25% on prime cost. The effect of this is shown below :—

Products	A	B	C
Actual Overhead incurred	Rs. 800	650	350
Overhead absorbed @ 25% on prime cost	700	750	300
Over/under absorption	(100)	100	(50)

In this situation relationship of material used and direct labour is not uniform. Therefore, application of recovery rate based on prime cost is not justifiable. This rate will be penalising the products with higher material consumption. In the present case, overhead should be charged based on direct labour cost, i.e.,

$$\begin{aligned}\text{Product A} &= \left(\frac{800}{1200} \times 100 \right) = 66\frac{2}{3}\% \\ \text{Product B} &= \left(\frac{650}{1000} \times 100 \right) = 65\% \text{ and} \\ \text{Product C} &= \left(\frac{350}{400} \times 100 \right) = 87\frac{1}{2}\%\end{aligned}$$

Computation of Various Overhead Absorption Rates

Problem 3.16. (a) Define selling and distribution overheads.

(b) Discuss the methods of allocation of selling and distribution expenses.

(c) The monthly budget of a department is as under :

The monthly budget of a department is as under .

Direct material	Rs. 45,000
Direct wages	Rs. 60,000
Overheads	Rs. 20,000
Direct labour hours	15,000
Machine hours	30,000

Find out the overhead recovery rate based on at least five different possible methods of absorption of overheads. (C.S. Inter, Dec. 1986)

Solution. (a) and (b) : Please refer to *Advanced Cost and Management Accounting—Text* by Saxena and Vashist.

(c) **Direct material cost method :**

$$\begin{aligned}\text{Overhead rate} &= \frac{\text{Amount of Overhead} \times 100}{\text{Cost of Direct material}} \\ &= \frac{\text{Rs. } 20,000}{45,000} \times 100 = 44\frac{4}{9}\% \text{ of direct material.}\end{aligned}$$

(ii) *Direct labour cost method :*

$$\text{Overhead rate} = \frac{\text{Amount of Overhead}}{\text{Cost of direct labour}} \times 100$$

$$= \frac{\text{Rs. } 90,000}{60,000} \times 100 = 150\% \text{ of direct labour cost}$$

(iii) *Prime cost method :* $\frac{\text{Amount of Overhead}}{\text{Prime cost}} \times 100$

$$= \frac{\text{Rs. } 90,000}{\text{Rs. } 1,05,000} \times 100 = 85.71\% \text{ of prime cost}$$

(iv) *Direct labour hour rate method :*

$$= \frac{\text{Rs. } 90,000}{15,000 \text{ hrs.}} = \text{Rs. } 6 \text{ per direct labour hour}$$

(v) *Machine hour rate method :*

$$\text{Overhead rate} = \frac{\text{Rs. } 9,000}{3,000} = \text{Rs. } 3 \text{ per machine hour}$$

Computation of Different Absorption Rates

Problem 3-17. The following particulars related to the production department of a factory for the month of June, 1985 :

Material used	Rs. 80,000	
Direct wages	Rs. 72,000	
Direct labour hours worked		20,000
Hours of machine operation		25,000
Overhead charges allocated to the department		Rs. 90,000

Cost data of a particular work order carried out in the above department during June, 1985 are given below :

Material used	Rs. 8,000	
Direct wages	Rs. 6,250	
Labour hours booked		3,300
Machine hour booked		2,400

What would be the factory cost of the work order under the following methods of charging overheads.

(i) Direct labour cost rate ;

(ii) Machine hour rate ; and

(iii) Direct labour hour rate.

(I.C.W.A., Inter, Dec. 1985)

Solution : It is required to work out the factory cost under the three methods of charging overhead. Factory cost is the sum total of prime cost (Direct material + Direct wages) and overhead.

OVERHEAD**P3.26**

Direct material	Rs. 8,000
Direct wages	6,250

Prime cost	14,250
------------	--------

Overhead recovery rates

$$(i) \% \text{ of Direct labour cost} = \frac{\text{Overhead}}{\text{Direct wages}} \times 100$$

$$(\text{Rs. } 90,000 \div 72,000) \times 100 = 125\%$$

Prime Cost	Rs. 14,250.00
------------	---------------

Add Overhead @ 125% direct wages (6,250 × 125%)	7,812.50
-------------------------------------------------	----------

Factory Cost	22,062.50
--------------	-----------

$$(ii) \text{ Machine hour rate} = \frac{\text{Rs. } 90,000}{25,000 \text{ hours}} = \text{Rs. } 3.60 \text{ per hour}$$

Prime Cost	Rs. 14,250
------------	------------

Add Overhead @ Rs. 3.60 per hour (2,400 × 3.60)	8,640
-------------------------------------------------	-------

Factory Cost	22,890
--------------	--------

$$(iii) \text{ Direct labour hour rate} = \frac{\text{Rs. } 90,000}{20,000 \text{ hours}} = \text{Rs. } 4.50 \text{ per hour}$$

Prime Cost	Rs. 14,250
------------	------------

Add Overhead @ Rs. 4.50 per direct labour hr. (3,300 × 4.50)	14,850
--------------------------------------------------------------	--------

Factory Cost	29,100
--------------	--------

Note : These three recovery rates of overhead substantially affect the factory cost. Selection of one of the methods will depend upon the purpose for which factory cost is being computed.

Computation absorption rate based on Direct Labour Hour and determination of Under/Over absorbed overhead

Problem 3.18. The cost accountant of a newly formed company was asked to establish a predetermined rate for applying overhead to the job moving through a single manufacturing shop and to check results periodically. After consulting various departments estimated data for the year 1983 :

		Actuals
Direct labour hours	1,44,000	1,21,500
Factory Supervision	Rs. 50,000	Rs. 51,000
Indirect Labour	1,15,000	99,000
Inspection	70,000	73,000

Maintenance	35,000	39,000
Indirect material	25,000	20,000
Heat, Light and Power	20,000	18,000
Depreciation	35,000	35,000
Misc. factory overhead	10,000	3,000

At the end of 1983, the first year of operations, the actual results were recorded against each item above. You are required to :

(a) Compute the predetermined overhead rate, based on direct labour hours ; also compute the incurred overhead rate ;

(b) Determine the under or over-applied overhead for the year ;

(c) Prepare journal entries to record all information pertaining to overhead, both in the general ledger and in the manufacturing expense subsidiary ledger.

(d) Explain the causes for under or overapplied overhead.

(I.C.W.A. Inter, Dec. 1984—adapted)

Solution. (a) Statement showing the predetermined overhead rate

	<i>Estimated</i>	<i>Actual</i>
Factory supervision	Rs. 50,000	Rs. 51,000
Indirect labour	1,15,000	99,000
Inspection	70,000	73,000
Maintenance	35,000	39,000
Indirect material	25,000	20,000
Heat, light and power	20,000	18,000
Depreciation	35,000	35,000
Misc. factory overhead	10,000	3,000
Total (A)	3,60,000	3,38,000
Direct labour hours (B)	1,44,000	1,21,500
Overhead rate per direct labour hour	Rs. 2.50	Rs. 2.782

(b) *Overhead recovered*

(a) Rs. 2.50 per hour (1,21,500 × 2.50)	Rs. 3,03,750
Unapplied overhead (Rs. 3,38,000—Rs. 3,03,750)	34,250
	<u>3,38,000</u>

(c) *Journal Entries***In General Ledger**

- | | | |
|--------------------------------------------------------------------|------------------|--------------|
| 1. Factory overhead control A/c | Dr. Rs. 3,38,000 | |
| To Accounts Payable A/c | | Rs. 3,38,000 |
| (Being factory overhead expenses transferred to subsidiary Ledger) | | |
| 2. Work-in-progress A/c | Dr. 3,03,750 | |
| To Factory Overhead Applied A/c | | 3,03,750 |
| (Being factory overhead charged to work-in-progress account) | | |

Subsidiary Ledger

Factory supervision A/c	Dr.	Rs. 51,000	
Indirect Labour A/c		99,000	
Inspection A/c	"	73,000	
Maintenance A/c	"	39,000	
Indirect Material A/c	"	20,000	
Heat Light and Power A/c	"	18,000	
Depreciation A/c	"	35,000	
Misc. Factory Overhead Payable A/c	"	3,000	
To Accounts Payable A/c			3,38,000
(Being the factory expenses as per General Ledger transferred to subsidiary Ledger)			

Computation of overhead absorption rates and under/over-absorption

Problem 3-19. The following information has been extracted from the management accounting records of W. Limited :

Budget for year ended 30th November 1986

	<u>Manufacturing Depts</u>		<u>Service Depts</u>	
	<u>Machining</u>	<u>Finishing</u>	<u>Maintenance</u>	<u>Administration</u>
	Rs.	Rs.	Rs.	Rs.
Sales	1,00,000	1,50,000	—	—
Direct Materials	30,000	50,000	—	—
Direct Labour	20,000	30,000	—	—
Variable Overheads	20,000	25,000	—	—
Fixed Overheads	15,000	18,000	7,260	4,000
Budgeted Direct Labour hours	8,000	12,000		

Actual figures for the past year were as follows :

	<i>Machining</i>	<i>Finishing</i>	<i>Maintenance</i>	<i>Administration</i>
	Rs.	Rs.	Rs.	Rs.
Direct Labour Hours	10,400	13,300		
Sales	1,30,000	1,70,000	—	—
Direct Materials	40,000	55,000	—	—
Direct Labour	28,000	35,000	—	—
Variable Overheads	25,000	27,000	—	—
Fixed Overheads	15,500	18,200	7,480	4,200

Service departments costs are apportioned as follows :

	<i>Maintenance</i>	<i>Administration</i>
	%	%
Machining	30	30
Finishing	50	40
Maintenance	—	30
Administration	20	—

Overhead costs in the Machine and Finishing departments are absorbed on a Direct Labour hour rate basis.

Required :

- Compute (i) the overhead cost absorption rates used during the year, and (ii) the budgeted trading results.
- Show the under or over-absorption of overheads during the year.
- Explain and illustrate the effect of volume on the absorption of fixed overheads.
- Given that the company is a jobbing engineering concern, explain how standard costing principles might be applied to its products.

(I.C.W.A. Final, June 1987)

Solution. Overhead Cost Absorption Rates

(i) Allocation of Service deptt. overheads to production deptts.

$$M \text{ (Maintenance)} = 7,260 \quad A \text{ (Administration)} = 4,000$$

But a certain percentage of these deptt. expenditure is incurred on each other.

$$\text{So } M = 7,260 + 3A \quad \text{and } A = 4,000 + 2M$$

$$\text{Solving the equations, } M = 9,000 \quad A = 5,800$$

Apportioning these expenses to manufacturing departments on basis of given ratio

	<i>Production Deptt.</i>		<i>Service Deptt.</i>	
	<i>Maintenance</i>		<i>Administration</i>	
Machining	2,700		1,740	
Finishing	4,500		2,320	
	<i>Machining</i>		<i>Finishing</i>	
	<i>Total</i>	<i>Rate</i>	<i>Total</i>	<i>Rate</i>
	<i>Overheads</i>	<i>per hr.</i>	<i>Overhead</i>	<i>per hr</i>
	(a)	(a)/8,000	(b)	(b)/12,000
Variable overhead	20,000	2.50	25,000	2.08
Fixed overhead	15,000	1.875	18,000	1.50
Maintenance overhead	2,700	0.3375	4,500	0.375
Administration overhead	1,740	0.2175	2,320	0.193
Composite Absorption Rate		4.93		4.148
				or 4.15

(ii) *Budgeted trading results*

	<i>Machining</i>	<i>Finishing</i>	<i>Total</i>
	Rs. 1,00,000	Rs. 1,50,000	Rs. 2,50,000
Sales			
Direct Material	30,000	50,000	80,000
Direct Labour	20,000	30,000	50,000
Variable overhead	20,000	25,000	45,000
Total variable cost	70,000	1,05,000	1,75,000
Contribution	30,000	45,000	75,000
Fixed overheads including			
Service depts. costs			
(given)	15,000	18,000	33,000
Share of Maintenance	2,700	4,500	7,200
„ Administration	1,740	2,320	4,060
Total Fixed Cost	19,440	24,820	44,260
Net Profit	10,560	20,180	30,740

(b) *Allocation of Actually Incurred Service Department Expenditure to Production Department*

$$M = 7480 + 3A \quad A = 4200 + 2M$$

Solving the two equations together

$$M = 9,298 \quad A = 6,060$$

	<i>Maintenance</i>	<i>Administration</i>
Machining	2,789	1,818
Finishing	4,649	2,424

Total actual overheads after allocation to service departments costs are :

	<i>Machining</i> Rs. 25,000	<i>Finishing</i> Rs. 27,000
Variable overheads		
Fixed overheads	15,500	18,200
Share of Service Deptt. :		
Maintenance	2,789	4,649
Administration	1,818	2,424
Total overhead incurred	45,107	52,273
Overhead absorbed		
10400 hrs × Rs. 4.93	51,272	
13300 hrs. × Rs. 4.15		55,195
Overhead over-absorbed during the year	6,165	2,922

(c) **Effect of volume on absorption of fixed overheads**

When under or over-recovery is only due to variation in production (i.e., actual production is less than or more than normal capacity) the amount of under/over-recovered overhead is only on account of fixed overheads. The variable overhead changes with the production and, therefore, there will be no difference in amount spent and recovered. In case of fixed overhead, overhead incurrence does not change with production but recovery changes with production. Hence there is difference between amount spent and recovered resulting in over-recovery (in case of increased production) and under-recovery (in case of decreased production).

Example : Budgeted fixed overheads = Rs. 1,00,000

Budgeted variable overhead = Rs. 20,000

Budgeted output = 10,000 unit

Recovery Rate = Rs. 30 per unit (Rs. 10 F + Rs. 20 V)

Actual Production = 9000 units

	<i>Spent</i>	<i>Recovered</i>	<i>Under recovery</i>
Fixed	Rs. 1,00,000	Rs. 90,000	Rs. 10,000
Variable	1,80,000	1,80,000	—
	2,80,000	2,70,000	10,000
	=====	=====	=====

It is clear that amount of under-recovery is only on account of fixed overhead because it is only due to change in production.

(d) Please refer to *Advanced Cost and Management Accounting—Text* by Saxena and Vashist.

Computation of Selling and Distribution overhead recovery rates

Problem 320. Following data is available relating to a company for a certain month :

	Territory		
	I	II	III
Selling expenses	Rs. 7,600	Rs. 4,200	Rs. 6,240
Distribution costs	Rs. 4,000	Rs. 1,800	Rs. 2,000
No. of units sold	16,000	6,900	10,000
Sales	Rs. 76,000	Rs. 28,000	Rs. 52,000

The company adopts sales basis and quantity basis for application of selling and distribution costs respectively. Compute (a) The territory-wise overhead recovery rates separately for Selling and Distribution Costs and (b) the amounts of selling and distribution costs chargeable to a consignment of 2,000 units of a product, sold in each territory at Rs. 4.50 per unit. (I.C.W.A. Inter, Dec. 1986)

Solution. (a) It is required to find out the territory-wise overhead recovery rates separately for selling cost and distribution cost.

For Selling Cost

Basis

Sales value

For Distribution Cost

Quantity basis

Note : Weight is a more appropriate basis for distribution cost. It is presumed that weight of each product sold in all the three territories is the same.

Therefore, overhead recovery rate formula

$$\text{Selling Cost Recovery Rate} = \frac{\text{Selling expenses}}{\text{Sales}} \times 100$$

$$\text{Distribution Cost Recovery Rate} = \frac{\text{Distribution cost}}{\text{No. of units sold}}$$

Overhead Recovery Rates for each territory

Territory	Selling Cost recovery rate	Distribution Cost recovery rate
I	$\frac{7,600}{76,000} \times 100$ or 10% of Sales	$\frac{4,000}{16,000}$ or Re 0.25 p.u.
II	$\frac{4,200}{28,000} \times 100$ or 15% of Sales	$\frac{1,800}{6,900}$ or Re 0.30 p.u.
III	$\frac{6,240}{52,000} \times 100$ or 12% of Sales	$\frac{2,000}{10,000}$ or Re 0.20 p.u.

(b) Computation of amounts of Selling and Distribution Costs chargeable to consignment

<i>Territory</i>	<i>I</i>	<i>II</i>	<i>III</i>
No. of units sold	2,000	2,000	2,000
Sales @ Rs. 4.50 p.u.	Rs. 9,000	Rs. 9,000	Rs. 9,000
Selling Cost chargeable	900	1,350	1,080
Distribution Cost chargeable	500	600	400
Total Selling & Distb. Costs	1,400	1,950	1,480

Selling Cost Analysis

Problem 3-21. A company is concerned about the profitability of selling to its small customers.

The following data were obtained from its records :

<i>Customer group by annual sales value</i>	<i>Total annual sales</i>	<i>Number of customers</i>	<i>Gross margin</i>	<i>Number of salesmen's calls p. r.</i>	<i>Number of orders p. a.</i>
Rs. 000	Rs. million		%		
Over 10	0.7	40	20	316	520
5 to 9.999	0.5	68	22	420	740
1.5 to 4.999	0.4	106	24	570	800
0.5 to 1.499	0.35	342	25	1,750	2,140
Under 0.5	0.3	1,800	25	3,750	4,500

Sales department costs :	Rs. '000
Sales management (central and regional)	p. a.
Salesmen's salaries	60.0
Salesmen's commission (5% of sales)	72.0
Salesmen's expenses	112.5
Sales office costs (excluding costs of handling sales orders)	33.0
	42.0
	319.5

Work study carried out indicated that the cost of handling sales orders was Rs. 2 per order. During the year there were 1,200 prospective customers on whom the salesmen made 2,200 calls but obtained no orders.

You are required to :

- Calculate for the year the
 - cost per salesman's call and
 - profit per customer group ;
- state with reasons whether the company should stop supplying directly those customers who buy under Rs. 500 of goods per annum from the company.

(C.I.M.A., London, Nov., 1986—Adopted)

Note : The name of ICMA (London) has now been changed to CIMA (London).

Solution. (a) (i) Sales Department Cost per annum :

Sales management	Rs. 60,000
Salesmen's salaries	72,000
Salesmen's commission	1,12,500
Salesmen's expenses	33,000
Sales office cost (excluding costs of handling sales orders)	42,000
	<u>3,19,500</u>
	=====

No. of salesmen's calls per annum
 $= 310 + 420 + 570 + 1750 + 3750 + 2200$ for
 prospective customers = 9000

Cost per salesman's call for the year

Rs. $3,19,500 \div 9000 =$ Rs. 35.50

(ii) Profit Per customer group

Customer group by annual sales value '000	Sales margin*	Annual cost of each call** (@ Rs. 35.50)	Order cost @ Rs. 2	Net profit (loss)
Over 10	Rs. 1,40,000	Rs. 11,005	Rs. 1,040	Rs. 1,27,955
5 to 9.999	1,10,000	14,910	1,480	93,610
1.5 to 4.999	96,000	20,235	1,600	74,165
0.5 to 1.4999	87,500	62,125	4,280	21,095
Under 0.5	75,000	1,73,125	9,000	(67,125)
Prospective Customer	—	78,100	—	(78,100)
	<u>5,08,500</u>	<u>3,19,500</u>		<u>1,71,600</u>
	=====	=====		=====

* Based on percentage of total annual sales given.

** $310 \times$ Rs. 35.50 and so on.

(b) Should the company stop supplying those customers buying less Rs. 500 of goods per annum ?

Based on the figures arrived at, (ii) answer is affirmative.

Under/Overabsorption of Overhead

Problem 3.22. The following particulars were extracted from the records of Epsilon Ltd. on 31st December :

	Deptt. A	Deptt. B	Deptt. C
Overhead incurred	Rs. 2,000	Rs. 1,500	Rs. 2,500
Overhead absorbed	2,200	1,400	2,250

The departmental loads during the three months to 31st December averaged :

Dept. A	100% of normal capacity
Dept. B	75% of normal capacity
Dept. C	50% of normal capacity

How would you deal with the balances under and over-absorbed ?
What preliminary enquiries would you make ? (ICWA Inter, Dec. 1985)

Solution.*Details**Departments*

	<i>A</i>	<i>B</i>	<i>C</i>
Overhead incurred	Rs. 2,000	Rs. 1,500	Rs. 2,500
Overhead absorbed	2,200	1,400	2,250
Over-absorbed	200		
Under-absorbed		100	250

Treatment of over-absorbed/under-absorbed overheads :

Department A : As the over-absorbed overhead is 10%, it is desirable to apply supplementary overhead rate and correspondingly give credit to the respective jobs.

Department B : As the under-absorbed overhead is less than 10%, it should be transferred to the current year's profit and loss account.

Department C : As the underabsorbed overhead is 10%, it is appropriate to apply supplementary overhead rate and give debit to the respective jobs.

The preliminary enquiries should be made on the lowest capacity utilization (50%) of department C. The reasons for this underutilized capacity should be further segregated into controllable and uncontrollable. Department B is also not able to fully utilize the capacity. It is advisable to consider this aspect in formulating next year's budgets by eliminating the unutilized capacity.

Income Statement after adjustment of under-applied overhead

Problem 3.23. The Menloco Company began business on 2nd January 1985. It made a variety of products, each batch requiring varying attention and effort. Predetermined overhead rates were computed on 2nd January 1985 as follows :—

$$\begin{aligned}\text{Variable Overheads} &= \frac{\text{Budgeted variable overheads}}{\text{Total expected activity}} \\ &= \frac{\text{Rs. } 50,000}{25,000 \text{ hrs.}} = \text{Rs. 2 per hour.}\end{aligned}$$

$$\begin{aligned}\text{Fixed Overheads} &= \frac{\text{Budgeted fixed overheads}}{\text{Total expected activity}} \\ &= \frac{\text{Rs. } 1,50,000}{25,000 \text{ hrs.}} = \text{Rs. 6 per hour.}\end{aligned}$$

A summary of results obtained for the month of January 1985 is given below :—

Direct material purchased	Rs. 1,10,000
Direct materials used	99,000
Direct labour cost incurred (21,250 hours @ Rs. 12.20).	2,59,250
Variable factory overhead incurred	42,000
Fixed Factory Overhead incurred	1,50,000

There was no work in process on 31-1-1985. The costs of goods sold (before considering under-applied overheads) was Rs. 3,96,188. The sales was Rs 6,00,000 and selling and administration expenses were Rs. 1,00,000. Prepare an income statement for the month where the under-applied overhead is considered as a direct adjustment of cost of goods sold and determine the gross and net profits. Ignore Income Tax
(ICWA Inter, June 1985)

Solution. Fixed factory overhead incurred	Rs. 1,50,000
Less : Fixed Overhead absorbed (21,250 hours × Rs. 6)	1,27,500
Under-absorbed overheads	22,500

Income statement showing gross profit and net profit

Total Sales	Rs. 6,00,000
Less : Cost of goods sold	Rs. 3,96,188
Under-absorbed overheads	22,500
	4,18,688
Gross profit	1,81,312
Less : Selling and administration expenses	1,00,000
Net profit	81,312

Disposal of under/over-absorbed overhead

Problem 3-24. Your company uses historical cost system and applies overheads on the basis of "predetermined" rates. The following are the figures from the Trial Balance as at 30-9-82 :

Manufacturing overheads	Rs. 4,26,544	Dr.
Manufacturing overheads applied	3,65,904	Cr.
Work-in-Progress	1,41,480	Dr.
Finished Goods Stock	2,30,732	Dr.
Cost of Goods Sold	8,40,588	Dr.

Give two methods for the disposal of the underabsorbed overheads and show the profit implications of each method.

(C.A. Inter, November 1983)

Solution. Actual Overheads	Rs. 4,26,544
Less : Overhead recovered	3,65,904
Overhead under-absorbed	60,640

Following two methods are available :

- Write off to profit and loss account
- Adjustment to cost of sales and inventories of WIP and finished goods.

When first method is followed, amount of Rs. 60,640 will be debited to Costing Profit and Loss Account resulting in the reduction of figure of profit for the year by Rs. 60,640.

Second approach stipulates that under-absorbed overhead should be distributed to three Control Accounts, i.e., Work-in-progress, Finished Goods Stock Account, and Cost of Goods Sold Account. This distribution can be attempted as follows.

	Balances	Additional Overhead (under-absorbed)	Total
Work-in-Progress	Rs. 1,41,480	7,074*	1,48,554
Finished Goods A/c	Rs. 2,30,732	11,537**	2,42,269
Cost of Sales A/c	Rs. 8,40,588	42,029***	8,82,617
	12,12,800	60,640	12,73,440

Working Notes

*	$(1,41,480 \div 12,12,800) \times 60,640$	Rs. 7,074
*	$(2,30,732 \div 12,12,800) \times 60,640$	11,537
***	$(8,40,588 \div 12,12,800) \times 60,640$	42,029

By using this method, profit for the year will be reduced by Rs. 23,418, i.e., Rs. 42,029 — (7,074 + 11,537). Amount of Rs. 42,029 will be debited to Profit and Loss Account with cost of sales. Amount of Rs. 18,611, i.e., Rs. 7,074 + Rs. 11,537 will get credited to Profit and Loss Account as value of closing stock. The amount of Rs. 18,611 will again get debited to profit and loss account next year as value of opening stock.

Treatment of under absorbed overhead

Problem 3-25. In a manufacturing unit, overhead was recovered at a predetermined rate of Rs. 25 per man-day. The total factory overhead incurred and the man-days actually worked were Rs. 41,50,000 and 1,50,000 respectively.

Out of the 40,000 units produced a period, 30,000 units were sold. There were also 30,000 uncompleted units which may be reckoned at 66⅔% complete.

On analysing the reasons, it was found that 40% of the unabsorbed overheads were due to defective planning and the rest were attributable to increase in overhead cost.

How would unabsorbed overheads be treated in cost accounts ?

(I.C.W.A. Inter, June 1984)

Solution.

Actual overhead incurred	Rs. 41,50,000
Overhead absorbed ($1,50,000 \times \text{Rs. } 25$)	Rs. 37,50,000
	<hr/>
Overhead under-absorbed	4,00,000
	<hr/>

It is given in the question that 40,000 units were produced, 30,000 units were sold and balance 10,000 units were in stock. Besides, 30,000 uncompleted units were there. These should be reckoned $66\frac{2}{3}\%$ complete. It is also given that 40% of the unabsorbed overhead was due to defective planning and the rest was due to increase in overhead, i.e., 60% of the balance.

1. \therefore 40% of unabsorbed overhead is due to bad planning. This should be directly debited to Profit and Loss A/c
(40% of Rs. 4,00,000) Rs. 1,60,000
2. Balance 60% should be distributed in W.I.P., finished good and Cost of Sales
(60% of Rs. 4,00,000) Rs. 2,40,000
Rs. 4,00,000

\therefore Rs. 2,40,000 have to be distributed on W.I.P., finished goods and cost of sales as follows :

(i) Work-in-progress ($2/3 \times 30,000$)	20,000 units
(ii) Finished Goods	10,000 units
(iii) Cost of Sales	30,000 units
Total	<hr/> 60,000 units

\therefore Rs. 2,40,000 will be allocated as follows :

(i) W.I.P. $2/6 \times 2,40,000$	Rs. 80,000
(ii) Finished Goods $1/6 \times 2,40,000$	Rs. 40,000
(iii) Cost of Sales $3/6 \times 2,40,000$	Rs. 1,20,000
	<hr/> Rs. 2,40,000

So the amount of Rs. 4,00,000 will be adjusted as follows :

Costing Profit and Loss A/c	Rs. 1,60,000
W.I.P. A/c	80,000
Finished Goods A/c	40,000
Cost of Sales	1,20,000
	<hr/>
	4,00,000

Following journal entries can be passed for this purpose :

- | | | | |
|-------------------------|-----|------------|--------------|
| W.I.P. progress A/c | Dr. | Rs. 80,000 | |
| Finished Goods A/c | Dr. | 40,000 | |
| Cost of Sales A/c | Dr. | 1,20,000 | |
| To Overhead Control A/c | | | Rs. 2,40,000 |
- | | | | |
|-----------------------------|-----|----------|----------|
| Costing Profit and Loss A/c | Dr. | 1,20,000 | |
| To Cost of Goods Sold A/c | | | 1,20,000 |

(Adjustment of unabsorbed overhead relating to cost of goods sold)
- | | | | |
|--------------------------|-----|----------|----------|
| Cost Profit and loss A/c | Dr. | 1,60,000 | |
| To Overhead control A/c | | | 1,60,000 |

(Being adjustment of unabsorbed overhead due to defective planning)

Determination of under, over absorbed overhead and its impact on W.I.P. and finished goods

Problem 326. A manufacturing company absorbs overhead into the cost of its four productive departments by means of estimated departmental rates per direct labour. In view of a large difference between overhead incurred and overhead absorbed for the year, you are asked to investigate. You discover the following information for the year :

Dept.	Overhead incurred Rs	Actual direct labour hours worked	Est. dept. rate used (Per D.L. Hr)	Total overhead absorbed	Direct labour hours contained in Work-in-progress	Finished goods
1	10,000	25,000	Re. 0.50	Rs. 12,500	3,000	7,000
2	42,000	84,000	0.35	29,400	14,000	8,000
3	20,250	45,000	0.40	18,000	7,000	4,000
4	18,000	36,000	0.60	21,600	6,000	3,000

What impact will it have on the valuation of year-end work-in-progress and finished goods and what do you like to suggest in such circumstances ?
(I.C.W.A. Inter, June 1984)

Solution. Statement showing over/under-absorbed overhead departmentwise

	Deptt. (1)	Deptt. (2)	Deptt. (3)	Deptt. (4)
(a) Actual overhead incurred (Rs.)	10,000	42,000	20,250	18,000
(b) Actual Direct labour hours	25,000	84,000	45,000	36,000
(c) Actual Direct labour hour rate	Rs. 0.40	Rs. 0.50	Rs. 0.45	Rs. 0.50
(d) Estimated Deptt. L.H. Rate used (per D.L. hour)	Rs. 0.50	Rs. 0.35	Rs. 0.40	Rs. 0.60
Difference in rate (over-absorption or under-absorption)	(-) 0.10	(-) 0.15	(-) 0.05	(+) 0.10

Note. Over-absorbed indicates (-) sign and under-absorbed indicates (+) sign. (For impact on WIP and Finished goods, refer to page P3-41)

Effect of Overhead on Profit

Problem 3-27. A manufacturing company has four production departments. Overhead is absorbed to its production departments by means of departmental rates per direct labour hour.

In a particular year there was a large difference between the overhead incurred and overhead absorbed. On analysis you get the following information.

	Departments			
	1	2	3	4
	Rs.	Rs.	Rs.	Rs.
Overhead incurred	12,320	44,385	18,180	15,720
Actual direct labour hour worked	30,800	80,700	40,400	34,400
Estimated department rate used	0.50	0.45	0.40	0.50
Total overhead absorbed	15,400	36,315	16,160	15,200
Direct labour hour contained in :				
Work-in-progress	3,000	10,400	1,900	7,200
Finished goods	4,300	8,300	4,000	2,900

You are required to (a) Calculate for each department the direct labour hour rates of overhead incurred. (b) Calculate the extent to which the value of work-in-progress and finished goods be increased or decreased for each department for the year in view of corrected rate. (c) What will be the impact on total profit of the company in view of the correction in (b) above ?

(Contd. on page P3-42)

Statement showing impact on W.I.P. and Finished Goods

	Departments				Total
	1	2	3	4	
<i>Impact on Work-in-progress</i>					
Direct labour-hour content in W.I.P.					
Difference in rate	3,000 (+) Re. 0.10	14,000 (-) Re. 0.15	7,000 (-) Re. 0.05	6,000 (+) Re. 0.10	
<i>Adjustment of amount required in W.I.P.</i>					
(i) Reduction where overhead was over-absorbed	(-) 300			(-) 600	} (+) Rs. 1,550
(ii) Addition where overhead was under-absorbed		(-) 2,100 (+)	350		
<i>Impact on Finished Goods</i>					
Direct labour-hour content in W.I.P.					
Difference in rate	7,000 (+) Re. 0.10	8,000 (-) Re. 0.15	4,000 (-) Re. 0.05	3,000 (+) Re. 0.10	
<i>Adjustment required in Finished Goods</i>					
(i) Reduction where overhead was over-absorbed	(-) Rs. 700			(-) Rs. 300	} (+) Rs. 400
(ii) Addition where overhead was under-absorbed		(+) Rs. 1,200	(+) Rs. 200		

Note. Where predetermined rate of overhead absorption is used, problem of over/under absorption of overhead arises. For this reason at the end of accounting period adjustments, as indicated above, are required to be carried out in value of W.I.P. and Finished Goods to find out the actual cost, which will be matched with market price to show inventory in Balance Sheet at lower of market value or actual cost.

Solution.(a) *Actual direct labour hours rates of each department :*

	Departments			
	1	2	3	4
Actual overhead	Rs. 12,320	44,385	18,180	16,720
Actual direct labour hours	30,800	80,700	40,400	30,400
Actual overhead rate/hr.	Re. 0.40	0.55	0.45	0.55
Estimated dept. rate used	0.50	0.45	0.40	0.50
Over/under-recovery	0.10	0.10	0.05	0.05
	over-recovery	under-recovery	under-recovery	under-recovery

Over-recovery of overhead means that the profit will be reduced and under-recovery of overhead means that the profit will be increased to the extent of total overhead under-recovered.

(b) *Value of W.I.P. and finished goods increased or decreased for each department by applying the corrected rates :*

Direct labour hours in contained in	Department			
	1	2	3	4
(i) W.I.P.	3,000	10,400	1,900	7,200
Amount of over/under recovery--	300	+1,040	+95	+360
(ii) Finished goods	4,300	8,300	4,000	2,900
Amount of over/under-recovery--	430	+830	+200	+145

So the value of W.I.P. and finished goods in respect of department 1 will have to be reduced by the above mentioned amounts. In other departments the value of W.I.P. and finished goods will have to be increased.

(c) *Impact on profit of correction in overhead rate :*

Total Over-recovery		Total
W.I.P.	(-) 300 in department 1	
Finished goods	(-) 430 in department 2	(-) 730
Total Under-recovery :		
W.I.P.	(+) 1,040 in department 2	
	(+) 95 in department 3	
	(+) 360 in department 4	(+) 1,495
Finished goods	(+) 830 in department 2	
	(+) 200 in department 3	
	(+) 145 in department 4	(+) 1,175
Impact on profit		(+) 1,940

Hence, the profit will go up by Rs. 1,940 by incorporating the above adjustments.

MISCELLANEOUS

Schedule of overhead rates and preparation of cost estimates

Problem 3.28. The budgeted costs of a manufacturing company for a normal year are as follows :

Direct materials	P.s.	Rs. 68,273
Direct wages :		
Machine shop (10,000 hours)	27,382	
Assembly shop (8,000 hours)	22,780	50,162
	<hr/>	
Works overhead :		
Machine shop	33,490	
Assembly	16,237	49,727
	<hr/>	
Administration overhead		12,268
Selling overhead		15,481
Distribution overhead		12,290

The absorption method of costing is in operation. You are required to :

(i) Prepare a Schedule of Overhead Rates for this business from the figures available.

(ii) Prepare a Cost Estimate for the following job based on the overhead rates so computed.

Direct material	20kg. @ Rs. 12 per kg.
	15kg. @ Rs. 2 per kg.
Direct labour	Machine shop 15 hours at Rs. 6 per hour
	Assembly 25 hours at Rs. 7 per hour.
	(I.C.W.A., Inter June, 1981)

Solution. (i) For schedule of overhead rates, refer to page P346

(ii) Job Cost Estimate

Elements of cost	Calculation	Amount
Direct materials	20kg. @ Rs. 12- Rs. 240 15kg. @ Rs. 2--Rs. 30	Rs. 270'00
Direct labour	Machine shop— 15 hrs. @ Rs. 6 -Rs. 90 Assembly shop— 25 hrs. @ Rs. 7 Rs. 175	 265'00
Prime cost		535'00

OVERHEAD**P3·44**

Works overhead	Machine shop— 15 hrs. @ Rs. 3·35 = Rs. 50·25 Assembly shop— 25 hrs. @ Rs. 2·03 = Rs. 50·75	101·00
<i>Works cost</i>		<u>636·00</u>
Administrative overhead	7·3% on Rs. 636·00	46·43
<i>Work and administrative cost</i>		<u>682·43</u>
Selling overhead	8·58% on Rs. 682·43	58·55
		<u>740·98</u>
Distribution overhead	7·37% on Rs. 682·43	50·30
		<u>791·28</u>
Estimated cost of sales		<u>791·28</u>

Problem 3·29. (Distribution of Selling overheads) XYZ Ltd., a manufacturing Company, having an extensive marketing network throughout the country, sells its products through four zonal sales offices, viz., A, B, C and D. The budgeted expenditure for the year is given below.

Sales Manager's Salary	Rs. 1,20,000
Expenses relating to Sales Manager's Office	80,000
Travelling Salesmen's Salaries	3,20,000
Travelling Expenses	36,000
Advertisements	30,000
Godown Rent : Zone 'A'	15,000
'B'	25,200
'C'	9,800
'D'	18,000
	<u>68,000</u>
Insurance on inventories	20,000
Commission on Sales @ 5% on Sales	6,00,000

The following further particulars are also available :

Zone	Sales in Rs. Lakhs	No. of Salesmen	Total Mileage Covered	Allocation of Advertisement	Average Stock Rs. Lakhs
A	36	5	6,000	30%	6
B	48	6	14,000	30%	8
C	16	2	4,500	20%	4
D	20	3	5,500	20%	2

Based on the above details, compute zonewise selling overheads as percentage to sales.

(J.C.W.A. Inter December, 1987)

Solution

Statement showing Distribution of Selling Overheads

S. No.	Item	Basis of Distribution	Total	Zones			
				A	B	C	D
				Rs.	Rs.	Rs.	Rs.
1.	Sales Manager's Salary	Sales	1,20,000	36,000	48,000	16,000	20,000
2.	S.M. Office expenses	Sales	80,000	24,000	32,000	10,667	13,333
3.	Salesmen's Salaries	No. of Salesmen	3,20,000	1,00,000	1,20,000	40,000	60,000
4.	Travelling expenses	Mileage covered	36,000	7,200	16,800	5,400	6,600
5.	Advertisement	Allocation Ratio	30,000	9,000	9,000	6,000	6,000
6.	Godown Rent	Actuals	68,000	15,000	25,200	9,800	18,000
7.	Insurance	Average stock Holding	20,000	6,000	8,000	4,000	2,000
8.	Commission on Sales	Sales	6,00,000	1,80,000	2,40,000	80,000	1,00,000
9.	Total		12,74,000	3,77,200	4,99,000	1,71,867	2,25,933
10.	Value of Sales		1,20,00,000	36,00,000	48,00,000	16,00,000	20,00,000
11.	Selling overhead as a % to Sales		10.62%	10.48%	10.40%	10.74%	11.30%

(a) Prepare an analysis of selling and distribution costs by products A, B and C ;

(b) Prepare an income statement for each product based on standard manufacturing costs and the analysis just completed.

(I.C.W.A., Inter, June 1983)

Solution. (a) **Statement Showing the Analysis of Selling and Distribution**

Sl. No.	Nature of selling expenses	Basis of Apportionment	Total Amount	A	B	C
			Rs.	Rs.	Rs.	Rs.
1.	Advertising	Advertising space (3 : 4 : 3)	4,000	1,200	1,600	1,200
2.	Direct selling	Salesmen's time (4 : 3 : 3)	12,000	4,800	3,600	3,600
3.	General office expenses	Sales volume (4 : 3 : 3)	3,480	1,392	1,044	1,044
4.	Ordering and billing	No. of invoices (2 : 1 : 4)	2,450	700	350	1,400
5.	Packing	Packing time * (4 : 3 : 1)	3,600	1,800	1,350	450
6.	Storage	@ (10 : 20 : 3)	5,060	1,533	3,067	460
Total selling and distribution cost			30,590	11,425	11,011	8,154

(b) **Statement Showing the Income Statement of Three Products**

	Total Rs.	A Rs.	B Rs.	C Rs.
Sales	50,000	24,000	18,000	18,000
Less : Variable mfg. cost	11,000	4,000	5,000	2,000
Contribution	49,000	20,000	13,000	16,000
Less : Fixed mfg. cost	9,000	4,000	1,000	4,000
Gross margin	40,000	16,000	12,000	12,000
Less : Selling and distribution cost	30,590	11,425	11,011	8,154
Profit	9,410	4,575	989	3,846

* It is given in the additional information that time required for packing products B and C is $\frac{3}{4}$ A and $\frac{1}{4}$ A respectively. In other words, product A required 1 hour of packing time, product B requires $\frac{3}{4}$ hour and product C requires $\frac{1}{4}$ hour. The proportion of packing time, thus, is 4 : 3 : 1 for products A, B and C respectively.

@, [Storage time × space occupied × unit sold]	$10 \times 1 \times 4,000$ or 40,000 or 10	$20 \times 2 \times 2,000$ or 80,000	$12 \times 1/2 \times 2,000$ or 12,000
	10	20	3

Segregation of Semi-Variable Maintenance Cost

Problem 3:30. The following are the maintenance costs incurred in a machine shop for six months with corresponding machine hours :

Month	Machine Hours	Maintenance costs
January	2,000	Rs. 300
February	2,200	320
March	1,700	270
April	2,400	340
May	1,800	280
June	1,900	290
Total	12,000	1,800

Analyse the maintenance cost, which is semi-variable, into fixed and variable element.
(C.A., Inter ; May, 1985)

Solution.

There are number of methods of segregating semi-variable, cost into fixed and variable element. First of all, variable element can be found out by applying only (i) Range or High and low method, and (ii) Average method.

For finding out variable element

(i) *Range Method :*

	Machine Hrs.	Maintenance cost
High—April	2,400	Rs. 340
Low—March	1,700	270
Difference	700	70

Variable cost per hour = $70 \div 700 = \text{Rs. } 0.10$

Variable cost for April = $2,400 \text{ Hrs.} \times \text{Rs. } 0.10 = \text{Rs. } 240$

Fixed cost = Total cost less variable cost = $\text{Rs. } 340 - 240 = \text{Rs. } 100$

(ii) *Average Method :*

	Machine Hours	Maintenance costs
Average for first two months	2,100	Rs. 310
Average for last two months	1,850	285
Difference	250	25

Variable element = $\text{Rs. } 25 \div 250$ or $\text{Rs. } 0.10$ [This is same as in (i) above.]

Analysis of maintenance cost into fixed and variable element

Month (1)	Machine Hours (2)	Maintenance Cost (3)	Variable Cost @ Rs. 0.10 per hour (4)	Fixed Cost (5) [Col 3—Col 4]
January	2,000	Rs. 300	Rs. 200	Rs. 100
February	2,200	320	220	100
March	1,700	270	170	100
April	2,400	340	240	100
May	1,800	280	180	100
June	1,900	290	190	100

Computation of variable and fixed costs

Problem 3'31. Firm X manufactures surgical goods. Its normal production is 2,600 units per month at a total cost of Rs. 32,000. At full capacity it can manufacture 3,400 units per month at a total cost of Rs. 38,000. Calculate :

- (i) average cost per instrument under normal operating conditions ;
 - (ii) average variable cost per instrument ;
 - (iii) total fixed cost ; and
 - (iv) average fixed cost under normal operating conditions.
- (C.S. Final, June, 1985)

Solution. (i) Average cost per instrument

$$\begin{aligned} &= \text{Total cost} \div \text{Normal production} \\ &= \text{Rs. } 32000 \div 2600 = \text{Rs. } 12.31 \end{aligned}$$

(ii) Average variable cost	= 3400 units	Rs. 38,000
	2600 units	Rs. 32,000
	<hr/>	<hr/>
Difference	800	6000

$$\text{Variable cost} = 6000 \div 800 = \text{Rs. } 7.50 \text{ per unit}$$

- (iii) Total fixed cost = Total cost - Total variable cost
 = Rs. 38,000 - (3400 × 7.50) or Rs. 12,500.

- (iv) Average fixed cost under normal conditions :

$$\begin{aligned} &= \text{Total fixed cost} \div \text{Normal production} \\ &= \text{Rs. } 12,500 \div 2600 = \text{Rs. } 4.81 \text{ per unit} \end{aligned}$$

Analysis of set-up cost and variable cost.

Problem 3'32. In a certain factory Type A and Type B machines have been designed to produce the same product but Type A is less automatic than Type B and requires somewhat more labour to operate. Pertinent costs are as follows :

	Type A	Type B
Set up cost	Rs. 400	Rs. 600
Variable cost per unit	4.80	4.40

Which type of machine should be used for processing various sized orders ?
 (I.C.W.A—Inter, December, 1984)

Solution. Difference in set up (fixed) cost

$$= \text{Rs. } 600 - 400 = \text{Rs. } 200$$

$$\text{Difference in variable cost per unit} = \text{Rs. } 4.90 - 4.40 = \text{Rs. } 0.50$$

$$\text{B.E.P.} = \frac{\text{Difference in set up cost}}{\text{Difference in variable cost}} = \frac{200}{\text{Rs. } 0.50} = 400 \text{ units}$$

At a production of 400 units the total costs of both the machines will be same.

	Type A	Type B
Set-up (Fixed) costs	Rs. 400	Rs. 600
Variable cost for 400 units	1,960	1,760
	2,360	2,360

Hence Machine A should be used for less than 400 units as its set up cost is lower. Machine B should be used for order of more than 400 units as its variable cost per unit is lower, which will offset the higher set-up costs. These points are made clear by verification of total costs at production levels of 399 units and 401 units.

Details	399 units		401 units	
	A	B	A	B
Set-up costs	Rs. 400·00	Rs. 600·00	Rs. 400·00	Rs. 600·00
Variable costs	1955·10	1755·60	1964·90	1764·40
	2355·10	2355·60	2364·90	2364·40
Preference	Type A		Type B	

Treatment of various research expenses

Problem 3·33. Wonder Devices Ltd. is manufacturing various surgical equipments. It has its own Engineering Research Centre where applied research is carried on.

On 1st January, 1984 three equipments were in process. During 1984, two more equipments were taken up for research and trial. The expenses booked on research during 1984 are as under :

	Rs.
Material cost	3,00,000
Labour cost	50,000
Factory overheads	10,000
Administration overheads	5,000
Regular and routine research	10,000

The relevant expenditure on research is allocated on the basis of percentage shown against each product in the following table :

Product	Opening balance	Allocation % for current year
(1) Multi Scanner	Rs. 4,000	30%
(2) Pulse Reader	15,000	20%
(3) Photo Censor	5,000	10%
(4) Blood Analyser	—	25%
(5) Cardiac Pace maker	—	15%

On 31-12-84 the results of various equipments were as under :

- (1) Multi Scanner : It was successfully developed and trial production of 100 units was made. Expected future production will be 10,000 pieces.
- (2) Pulse Reader was a total failure.
- (3) Photo censor is still under development.
- (4) Blood Analyser is under trial.
- (5) Cardiac pace maker : It is successfully developed. The patent rights have been sold to M/s E Appliances Ltd. at 30% profit.

Please give your advice how the expenditure after allocation will be treated in the books of account of Wonder Devices. Also state the treatment to be given to regular and routine research expenses.

(I.C.M.A. Final Dec., 1985)

Solution	Allocation of expenditure on research (Rs.)					
Particular	Total	Multi-scanner	Pulse Reader	Photo Censor	Blood Analyser	Cardiac Pace Maker
(a) Opening balance 1984 research cost (Rs. 3,65,000) excl. regular and routine research	21,000	4,000	15,000	5,000	—	—
(b) Add:	3,65,000	1,09,500	73,000	36,500	91,250	54,750
Total (a + b)	3,89,000	1,13,500	88,000	41,500	91,250	54,750

Treatment of research expenditure after allocation

Treatment of expenditure

1. Multi-scanner Rs. 1,13,500 Total production (10,000+100=10,100)
Recovery Rate = Rs. 1,13,500 ÷ 10,100 = Rs. 11.24 per price
(a) Cost of 100 pieces amounting to Rs. 1124 will be debited to P&L A/c
(b) Balance amount of Rs. 1,12,376 will be capitalised as development expenses. On regular production research cost @ Rs. 11.24 per piece will be recovered.
2. Pulse Reader 88,000 It was a total failure and, therefore, this amount will be debited to P & L A/c
3. Photo Censor 41,500 This amount will be carried forward to W.I.P. A/c.
4. Blood Analyser 91,250 To be carried forward as W.I.P.

5. Cardiac Pace Maker	54,750	Profit @ 30% of 54,750 = Rs. 16,425 to be credited to P. & L A/c. Sales value will be Rs. 54,750 + 16,425 = Rs. 71,175. Following journal entry will be passed.
	Bank A/c	Dr. Rs. 71,175
	To Research A/c (Cardiac)	Rs. 54,750
	To P & L A/c	16,425

Treatment of regular and routine research : Rs. 10,000. As this is an ongoing activity, this amount will be treated as factory overheads and allocated to production on a suitable basis.

Analysis of selling and administrative expenses by product line

Problem 3'34. Domestics Ltd., makes three basic types of household products. Production statistics for the past year are given below :

	Unit	Product 1	Product 2	Product 3
No. of units manufactured	No.	1,20,000	80,000	60,000
Direct Material Cost	Rs.	2,76,000	Rs. 1,36,000	Rs. 2,64,000
Direct Labour Cost		96,000	56,000	60,000
Manufacturing Overhead		48,000	28,000	30,000
Total		4,20,000	2,20,000	3,54,000

The selling and administrative cost for the year were as follows :

Sales salaries	Rs. 52,000
Sales commission	1,42,700
Advertising	28,400
Travel and entertainment	15,200
Delivery expense	8,000
Sales office expense	21,000
Office salaries	18,500
Office supplies used	3,200
Administrative office expenses	6,100
	<u>2,95,100</u>

Product 1 and 2 were sold at 40 per cent above manufactured cost, while Product 3 was sold at 50 per cent above its manufactured cost.

Domestics Ltd., has devoted a great deal of time and effort in developing sales of Product 3. The management is now questioning the wisdom of this policy and has authorised a study of selling and administrative cost by product lines.

An analysis reveals the following :

Cost	Basis of allocation	Product lines		
		1	2	3
Sales salaries, travel and entertainment	Percentage of time devoted to each line	20	20	60
Advertising	Percentage basis	30	20	50
Sales commissions	10% of net sales	—	—	—
Sales office expenses	No. of orders	150	30	120
Office salaries	No. of orders			
Office supplies used	No. of orders			
Administrative office Expenses	No. of orders			
Delivery expenses	Weight-distance ratios	30	30	40

All production for the year was sold, with no inventory costs carried forward from the beginning of the year and no returns of sales by customers. Required :

- Prepare a profit statement with all costs broken down according to product line.
- Indicate which product line shows the higher rate of profit to sales and which the least. (ICWA Final, December, 1985)

Solution. (i) Profit statement with all costs broken down according to product line.

Particulars	Basis of allocation	Products			Total
		1	2	3	
		Rs.	Rs.	Rs.	Rs.
Manufacturing cost	as given	4,20,000	2,20,000	3,54,000	9,94,000
Above Mfg. cost	40%	1,68,000	88,000		
Above Mfg. cost	50%			1,77,000	4,33,000
A. Sales		5,88,000	3,08,000	5,31,000	14,27,000
B. Manufacturing cost		4,20,000	2,20,000	3,54,000	9,94,000
C. Selling and Adm. :					
Sales salaries	20 : 20 : 60	10,400	10,400	31,200	52,000
Sale comm.	10% of sales	58,800	30,800	53,100	1,42,700
Advertising	30 : 20 : 50	8,520	5,680	14,200	28,400
Travel and entertainment	20 : 20 : 60	3,040	3,040	9,120	15,200
Delivery exp.	30 : 30 : 40	2,400	2,400	3,200	8,000
Sales off. exp.	No. of orders	10,500	2,100	8,400	21,000
Office salaries	No. of orders	9,250	1,850	7,400	18,500
Office supplies	No. of orders	1,600	320	1,280	3,200

Adm. office exp.	No. of orders.	3,050	610	2,440	6,100
Total C		1,07,560	57,200	1,30,340	2,95,100
Total Cost (B+C)		5,27,560	2,77,200	4,84,340	12,89,100
Profit		60,440	30,800	46,660	1,37,900
(ii) Rate of profit to sales		10·28%	10%	8·79%	

Segregation of variable and fixed overheads

Problem 3·35. Meera Industries Limited is a single product organisation having a manufacturing capacity of 6,000 units per week of 48 hours. The output data vis-a-vis different elements of cost for three consecutive weeks are given below :

Units Produced	Direct Material	Direct Labour	Total Factory Overheads (Variable and Fixed)
2400	Rs. 4800	Rs. 6000	Rs. 37,200
2800	5600	7000	38,400
3600	7200	9000	40,800

As a Cost Accountant, you are asked by the company management to work out the selling price assuming an activity level of 4000 units per week and a profit of 20% on selling price.

(I.C.W.A., Inter, Dec., 1986 and C.A. Final—Modified)

Solution. Production and different elements of cost for three consecutive weeks have been given. Total factory overheads have to be segregated into variable and fixed overheads. The variable portion will be :

$$= \frac{\text{Change in total factory overheads}}{\text{Change in production level}} = \frac{38,400 - 37,200}{2,800 - 2,400}$$

$$= \text{Rs. 3 per unit}$$

Fixed factory overheads = (Total fixed overheads at 2400 units less variable overhead at 2400 units)

$$= \text{Rs. } 37,200 - (2400 \times 3) = \text{Rs. } 30,000.$$

Computation of selling price at 4000 units

Direct material @ Rs. 2 per unit	Rs. 8,000
Direct labour @ Rs. 2·50 per unit	10,000
Variable overheads @ Rs. 3 per unit	12,000
Fixed factory overheads	30,000
Total factory cost	60,000
Profit (20% of S.P. or 25% of cost)	15,000
Total selling price	75,000
Selling price per unit	18·75

Authors' Special Notes

1. Most of the questions relate to departmentalisation, computation of overhead rate and under/over-absorption.

2. Note (i) relative impact of departmental overhead rates and plant-wise overhead rates (Problem 3-7), (ii) comprehensive overhead rate (Problem 3-8) (iii) segregation of variable and fixed overheads (Problem 3-35) (iv) use of machine with or without computer (Problem 3-14)

3. Direct questions are not asked at final level. Note (i) use of algebraic equation in Problem 3-19 and (ii) Selling cost analysis in Problems 3-21 and 3-34

**BREAK UP OF THE PROBLEMS RELATING TO OVERHEADS
ACCORDING TO DIFFERENT LEVELS (FOR PROBLEMS
WITH PREFIX A, REFER TO APPENDIX A)**

Intermediate Level

Departmentalisation of Overheads—P 3-1, 3-2, 3-3, 3-4, 3-5, A 5, A 89

Computation of Overhead Rates—P 3-6, 3-7, 3-8, 3-9, 3-10, 3-11, 3-12, 3-13, 3-14, 3-15, 3-16, 3-17, 3-18, 3-20, A28, A39, A58, A59, A164

Under/OverAbsorption—P 3-22, 3-23, 3-24, 3-25, 3-26, 3-27, A 40

Miscellaneous—P 3-28, 3-29, 3-30, 3-31, 3-32, 3-35, A 77, A 106, A 166

Final Level

Computation of Overhead Rates—P 3-19, 3-21, A 18

Miscellaneous—P 3-33, 3-34

Please also refer to the Examples 4-1 to 4-16 of the book "Advanced Cost and Management Accounting—Text" by Saxena and Vahist

Cost Book-Keeping

[*Cost Control Accounts and Integral Accounts 4.1—4.6; Reconciliation of Cost Accounts and Financial Accounts 4.7—4.10*]

COST CONTROL ACCOUNTS AND INTEGRAL ACCOUNTS

Journal Entries in Control Accounts

✓ **Problem 4.1.** How will you transact the following in the material account and the stores ledger?

(a) Material ledger shows 120 units at an average cost of Rs. 10 while the physical count is 110 units, difference due to non-recording of a material requisition note

(b) Physical units show 200 while the ledger balance shows a shortage due to non-receipt of an invoice for 20 units for a total cost of Rs. 100

(c) Ledger balance indicates an excess of 50 units over the physical balance effected by atmospheric changes which are normal. The issue rate is Rs. 3.00 per unit

(d) Physical balance shows a shortage compared to the ledger balance of 10 units traced to have been an effect of excess issue of material to a production job. The issue price is Rs. 2.50 per unit.

(I.C.W.A. Inter, June, 1985)

Solution. (a) Difference of 10 units @ Rs. 10 each due to non-recording of a material requisition note to be posted in issue column of store ledger.

W.I.P. A/c	Dr.	Rs. 100	
	To Stock Control Account		Rs. 100

(b) Invoice for 20 units to be posted in the receipt column

Stock Control A/c	Dr.	100	
	To General Ledger A/c		100

(c) Ledger balance shows an excess of 50 units over the physical balance, considered normal loss due to atmospheric changes and debited to production overhead. (To be shown in issue column)

Production Overhead Control A/c	Dr.	150	
	To Stock Control A/c		150

(d) There are two treatments for excess issue :

(i) The excess issue may be reversed ; or

(ii) Excess issue may be debited to Production Account (To be shown in issue column)

W.I.P. A/c	Dr.	25	
To Stock Control A/c			25

Control Accounts and Costing P and L A/c

Problem 42. At the beginning of February 1987 the opening balances in the cost ledger of Good Luck Ltd. were :

Stores Ledger Control Account	Rs.	3,64,000
Work in Progress Control Account		2,30,000
Finished Goods Control Account		1,57,000
Cost Ledger Control Account		7,51,000

During February 1987 the following transactions took place :

Materials purchased	Rs.	2,87,000
Materials issued to :		
Production		2,13,000
Service Departments		42,000
The construction of manufacturing equipment		56,000
Gross Factory wages paid (of these gross wages Rs. 1,95,000 were indirect wages, Rs. 66,000 was incurred in the construction of manufacturing equipment and the balance was direct wages)		5,89,000
Production overheads incurred (excluding the items shown above)		19,700
Production overheads absorbed in construction of manufacturing equipment		36,300
Unabsorbed production overhead in February 1987		40,000
Raw material stocks damaged and written off		12,000
Selling overheads incurred and charged to cost of sales		1,05,000
Sales		8,80,000

The company's gross profit margin is 25% on factory cost.

Royalty payments for manufacture of product EXE under licence	3,000
---------------------------------------------------------------	-------

At the end of February 1987, stocks of work in progress were Rs. 76,400 higher than at the beginning of the month. The equipment under construction was completed on 25th February and transferred out of the cost ledger at the end of the month.

Required : Prepare the Control Accounts and Costing Profit and Loss Account which would show the effect of these transactions in February 1987
(C.A. Final May 1987)

Solution. Cost Ledger Control A/c

<i>Dr.</i>		<i>Cr.</i>	
To Sales A/c	Rs. 8,80,000	By Balance b/d	Rs. 7,51,000
„ Capital work in progress	1,58,300	„ S. Ledger Control A/c	2,87,000
„ Balance c/d	7,35,400	„ Factory Wages Control A/c	5,89,000
		„ Production Overhead A/c	19,700
		„ Cost of Sales A/c (For selling O.H.)	1,05,000
		„ W.I.P. — Royalty	3,000
		„ Costing P & L A/c (Profit)	19,000
	<u>17,73,700</u>		<u>17,73,700</u>
		By Balance b/d	7,35,400

Stores Ledger Control A/c

To Balance b/d	3,64,000	By Work-in-progress A/c	2,13,000
„ Cost Ledger Control A/c	2,87,000	„ Production overhead Control A/c	42,000
		„ Capital Work-in Progress A/c	56,000
		„ Costing P & L A/c	12,000
		„ Balance c/d	3,28,000
	<u>6,51,000</u>		<u>6,51,000</u>

Work-in-Progress Control A/c

To Balance b/d	Rs. 2,30,000	By Finished Goods	Rs. 6,48,000*
„ Stores Control A/c	2,13,000	By Balance c/d	
„ Wages control A/c	3,28,000	(2,30,000 + 76,400)	3,06,400
„ Production Overhead A/c	1,80,400		
„ Cost Ledger Control A/c	3,000		
	<u>9,54,400</u>		<u>9,54,400</u>

*Balancing figure.

Finished Goods Control A/c

To Balance b/d	Rs. 1,57,000	By Cost of Sales	Rs. 7,04,000*
„ Work-in-Progress	6,48,000	„ Balance c/d	1,01,000
	<u>8,05,000</u>		<u>8,05,000</u>

*Selling Price of goods sold	8,80,000
Less Gross profit 25% on F. cost or 20% of S. Price	1,76,000
	<hr/>
Factory Cost of Sales	7,04,000
	<hr/> <hr/>

Production Overhead Control A/c

<i>Dr.</i>				<i>Cr.</i>
To Stores Ledger Control A/c	Rs. 42,000	By Capital Work-in-Progress	Rs. 36,300	
„ Wages Control A/c	1,95,000	„ Work-in-Progress A/c	1,80,400	
„ Cost Ledger Control A/c	19,700	By Costing P & L A/c	40,000	
		(unabsorbed overhead)		
	<hr/>		<hr/>	
	2,56,700		2,56,700	
	<hr/> <hr/>		<hr/> <hr/>	

Capital Work-in-Progress Account

To Stores Ledger Control A/c	56,000	By Cost Ledger Control A/c	1,58,300
„ Wages Control A/c	66,000		
„ Production Overhead A/c	36,300		
	<hr/>		<hr/>
	1,58,300		1,58,300
	<hr/> <hr/>		<hr/> <hr/>

Wages Control A/c

To Cost Ledger Control A/c	5,89,000	By Production Overhead A/c	1,95,000
		„ Capital Work-in-Progress	66,000
		„ Work-in Progress A/c	3,28,000
	<hr/>		<hr/>
	5,89,000		5,89,000
	<hr/> <hr/>		<hr/> <hr/>

Cost of Sales A/c

To Finished Goods A/c	7,04,000	By Costing P & L	8,09,000
„ Cost Ledger Control A/c (For selling overhead)	1,05,000		
	<hr/>		<hr/>
	8,09,000		8,09,000
	<hr/> <hr/>		<hr/> <hr/>

Costing P & L A/c

	Rs.		Rs.
To Cost of Sales A/c	8,09,000	By Sales	8,80,000
„ Store Ledger Control A/c	12,000		
„ Production overhead control A/c	40,000		
„ Cost Ledger control A/c (profit)	19,000		
	<u>8,80,000</u>		<u>8,80,000</u>

Sales A/c

To Costing P & L A/c	<u>8,80,000</u>	By Cost Ledger Control A/c	<u>8,80,000</u>
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Trial Balance

Stores Ledger Control A/c	3,28,000		
Work-in-Progress A/c	3,06,400		
Finished Goods A/c	1,01,000		
General Ledger Control A/c			7,35,400
	<u>7,35,400</u>		<u>7,35,400</u>

Ledger Accounts, Income Statements and B/S

Problem 4'3. ABC Ltd. operates an integrated accounting system and the following details are given for the year ended 31st March, 1986 :

Trial Balance as on 31st March, 1986

	Debit	Credit
Share Capital		Rs. 20,00,000
Reserves		2,00,000
Creditors for purchases		1,50,000
Expense Creditors		20,000
Freehold buildings, at cost	Rs. 5,00,000	
Plant and Machinery, at cost	3,00,000	
Provision for depreciation on plant and machinery		1,00,000
Stock of :		
Raw Material	2,20,000	
Work-in-Progress	40,000	
Finished goods	60,000	
Debtors	2,00,000	
Bank	1,50,000	
	<u>24,70,000</u>	<u>24,70,000</u>

The following data for the month of April 1986 are given

Raw material purchased on credit	Rs. 9,90,000
Raw material returned to suppliers	40,000
Material issued to production	8,50,000
Material returned from shop floor	20,000
Factory wages paid :	
Productive	2,50,000
Non-productive	50,000
Salaries paid :	
Administration	1,00,000
Selling and Distribution	75,000
Overhead expenses incurred but not paid	
Production	3,00,000
Administration	50,000
Selling and Distribution	1,00,000
Depreciation for the month on plant and machinery	50,000
Sales on Credit	20,00,000
Cash received from debtors	19,50,000
Paid the following by cheque :	
Creditors for Purchases	10,00,000
Creditors for Expenses	4,30,000
Production overhead applied to production	3,90,000
Administration overhead applied to finished goods	1,45,000
Selling and distribution overhead applied to cost of sales	1,80,000
Closing Stocks :	
Work-in-Progress	2,10,000
Finished goods	2,15,000

Required :

- Show the appropriate ledger accounts.
- Prepare the income statement for April 1986.
- Prepare the Balance Sheet as at 30th April, 1986.

(C.A. Final, May 1986)

Solution.

Share Capital A/c

	By Balance b/d	Rs. 20,00,000
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Reserves

	By Balance b/d	Rs. 2,00,000
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Creditors for Purchases

To Creditor for purchases	Rs. 40,000	By Balance b/d	Rs. 1,50,000
" Bank A/c	10,00,000	" Purchases	9,90,000
" Balance c/d	1,00,000		
	11,40,000		11,40,000
	=====	By Balance b/d	1,00,000

<i>Dr.</i>	Creditors for expenses		<i>Cr.</i>
To Bank A/c	Rs. 4,30,000	By Balance b/d	Rs. 20,000
„ Balance c/d	40,000	„ Production O.H. A/c	3,00,000
		„ Adm. O.H.	50,000
		„ S & D O.H.	1,00,000
	4,70,000		4,70,000
		By Balance b/d	40,000

Freehold Building

To Balance b/d	5,00,000
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Plant and Machinery

To Balance b/d	13,00,000
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Provision for Depreciation

To Balance c/d	Rs. 1,50,000	By Balance b/d	Rs. 1,50,000
		„ Prod. O.H. A/c	50,000
	1,50,000		1,50,000
		„ Balance c/d	1,50,000

Raw Material A/c

To Balance b/d	Rs. 2,20,000	By Cr. for purchases	Rs. 40,000
„ Cr. for purchases	9,90,000	„ W.I.P.	8,50,000
„ W.I.P. A/c	20,000	„ Balance c/d	3,40,000
	12,30,000		12,30,000
To Balance b/d	3,40,000		

Work-in-Process A/c

To Balance b/d	Rs. 40,000	By Raw. Mat. A/c	Rs. 20,000
„ Raw. Mat. A/c	8,50,000	„ Finished Goods A/c	13,00,000
„ Wages Control A/c	2,50,000	„ Balance c/f	2,10,000
„ Production O.H. A/c	3,90,000		
	15,30,000		15,30,000
„ Balance b/d	2,10,000		

Finished Good A/c

To Balance b/d	Rs. 60,000	By Cost of Sales A/c	Rs. 12,90,000
„ Adm. O.H. A/c	1,45,000	(Balancing figure)	
„ W.I.P. A/c	13,00,000	„ Balance c/f	2,15,000
	15,05,000		15,05,000
„ Balance b/d	2,15,000		

Debtors

To Balance b/d	Rs. 2,00,000	By Bank	Rs. 19,50,000
„ Sales A/c	20,00,000	„ Balance c/d	2,50,000
	<u>22,00,000</u>		<u>22,00,000</u>
„ Balance b/d	2,50,000		

Bank

	Rs.		Rs.
To Balance b/d	1,50,000	By Wages Control A/c	4,75,000
„ S. Debtors	19,50,000	„ Creditors for purchases	10,00,000
		„ Creditors for expenses	4,30,000
		„ Balance c/d	1,95,000
	<u>21,00,000</u>		<u>21,00,000</u>
„ Balance b/d	1,95,000		

Wages Control A/c

To Bank A/c	Rs. 4,75,000	By W.I. P	Rs. 2,50,000
		„ Prod. O.H. A/c	50,000
		„ Adm. O.H. A/c	1,00,000
		„ S & D O.H. A/c	75,000
	<u>4,75,000</u>		<u>4,75,000</u>

Production O.H. A/c

To Wages Control A/c	Rs. 50,000	By W.I. P	Rs. 3,90,000
„ Cr. for exp. A/c	5,00,000	„ P and L A/c	10,000
„ Provision for Dep.	50,000	(under-absorption)	
	<u>4,00,000</u>		<u>4,00,000</u>

Adm. O.H. A/c

To Wages Control A/c	Rs. 1,00,000	By Finished Goods A/c	Rs. 1,45,000
„ Cr. for Exp. A/c	5,00,000	P and L A/c	5,000
		(under-absorption)	
	<u>1,50,000</u>		<u>1,50,000</u>

Dr.

S and D Overhead A/c

Cr.

To Wages Control A/c	Rs. 75,000	By Cost of Sales A/c	Rs. 1,80,000
„ Creditor for exp.	1,00,000		
„ P & L A/c	5,000		
(over-absorption)			
	<u>1,80,000</u>		<u>1,80,000</u>

Dr.	Cost of Sales A/c		Cr.
To F. Goods A/c	Rs. 12,90,000	By P & L A/c	Rs. 14,70,000
„ S & D OH.	1,80,000		
	<u>14,70,000</u>		<u>14,70,000</u>
Sales A/c			
	Rs.		Rs.
To P & L A/c	20,00,000	By S. Drs.	20,00,000
	<u>20,00,000</u>		<u>20,00,000</u>

(b) Income Statement for April 1986
P & L A/c for the period ending 30th April 1986

To Cost of Sales A/c	Rs. 14,70,000	By Sales A/c	Rs. 20,00,000
„ Adm. OH. A/c	5,000	„ S & D OH. A/c	5,000
„ Prod. OH. A/c	10,000		
„ Net profit	5,20,000		
	<u>20,05,000</u>		<u>20,05,000</u>

(c) Balance Sheet as on 30th April 1986

Liabilities		Assets	
Share Capital	Rs. 20,00,000	Fixed Assets	Rs.
Reserves	2,00,000	Buildings	Rs. 5,00,000
Net Profit	5,20,000	Plant & Mach.	13,00,000
Creditors :			
For Purchases	1,00,000		18,00,000
For Expenses	40,000	Less Provision for depreciation	1,50,000
	<u>1,40,000</u>		<u>16,50,000</u>
		Current Assets :	
		Raw Materials	3,40,000
		Debtors	2,50,000
		W.I.P.	2,10,000
		Finished Stock	2,15,000
		Bank A/c	1,95,000
	<u>28,60,000</u>		<u>12,10,000</u>
			<u>28,60,000</u>

Integrated Accounts

Problem 4.4. Messrs. Essbee Ltd. maintain Integrated Accounts of Cost and Financial Accounts. From the following details write up control accounts in the general ledger of the factory and prepare a trial balance :

Share Capital	Rs. 3,00,000
Reserve	2,00,000
Sundry Creditors	5,00,000
Plant and Machinery	5,75,000
Sundry Debtors	2,00,000
Closing Stock	1,50,000
Bank & Cash balance	75,000
Transactions during the year were as follows .	
Stores purchased	10,00,000
Stores issued to Production	10,50,000
Stores in hand	95,000
Direct wages incurred	6,50,000
Direct wages charged to production	6,00,000
Manufacturing expenses incurred	3,00,000
Manufacturing expenses charged to production	2,75,000
Selling and distribution expenses	1,00,000
Finished Stock production (at cost)	18,00,000
Sales at selling price	22,00,000
Closing Stock	95,000
Payment to Creditors	11,00,000
Receipt from Debtors	21,00,000

(I C.W.A. Inter, June 1985)

Solution.		Share Capital A/c	
			Rs.
		By Balance b/d	3,00,000
		Reserve A/c	
To Balance b/d	Rs. 5,15,000	By Balance b/d	Rs. 2,00,000
		„ Costing P & L A/c	3,15,000
	5,15,000		5,15,000
		Balance b/d	5,15,000
		S. Creditors A/c	
To Bank A/c	Rs. 11,00,000	By Balance b/d	Rs. 5,00,000
„ Balance c/d	4,00,000	„ Stock control A/c	10,00,000
	15,00,000		15,00,000
		By Balance b/d	4,00,000
		Plant & Machinery A/c	
To Balance b/d	Rs. 5,75,000		
		S. Debtors A/c	
To Balance b/d	2,00,000	By Bank A/c	21,00,000
„ Sales	22,00,000	„ Balance c/d	3,00,000
	24,00,000		24,00,000
„ Balance b/d	3,00,000		

Stock Control A/c

To Balance b/f	Rs. 1,50,000	By W.I.P. A/c	Rs. 10,00,000
„ S. creditors	10,00,000	„ Mfg. O.H. Control A/c	5,000*
		„ Balance c/d	95,000
	<u>11,50,000</u>		<u>11,50,000</u>
To balance b/d	95,000		

*It is presumed that difference was issued for indirect material.

Bank A/c

To Balance b/f	Rs. 75,000	By Wages Control	Rs. 6,50,000
„ S. Debtors	21,00,000	„ P.O.H control A/c	3,00,000
		„ Selling exp.	1,00,000
		„ S. Creditors	11,00,000
		„ Balance c/f	25,000
	<u>21,75,000</u>		<u>21,75,000</u>
Balance b/d	25,000		

W.I.P. A/c

To Stores control A/c	Rs. 10,50,000	By Finished Stock A/c	Rs. 18,00,000
„ Wages control A/c	6,00,000	„ Balance c/d	1,25,000
„ P.O.H. control A/c	2,75,000		
	<u>19,25,000</u>		<u>19,25,000</u>
To Balance b/f	1,25,000		

Wages Control A/c

To Bank A/c	Rs. 6,50,000	By W.I.P. A/c	Rs. 6,00,000
		„ P. OH. A/c	50,000
	<u>6,50,000</u>		<u>6,50,000</u>

Production Overhead Control A/c

To Stores control A/c	Rs. 5,000	By W.I.P. A/c	Rs. 2,75,000
„ Bank A/c	3,00,000	„ P & L A/c	80,000
„ Wages control A/c	50,000	(under-absorption)	
	<u>3,55,000</u>		<u>3,55,000</u>

Selling & Distribution Overhead Control A/c

To Bank A/c	Rs. 1,00,000	By Cost of Sales	Rs. 1,00,000
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Cost of Sales A/c

	Rs.		Rs.
To F. Stock control A/c	17,05,000	By Costing P & L A/c	18,05,000
To S&D O.H. control A/c	1,00,000		
	<u>18,05,000</u>		<u>18,05,000</u>

Finished Stock Control A/c

	Rs.		Rs.
To W.I.P. A/c	18,00,000	By Cost of Sales A/c	17,05,000
		„ Balance c/d	95,000
	<u>18,00,000</u>		<u>18,00,000</u>

To Balance A/c	95,000
	Sales A/c

	Rs.		Rs.
To Costing P & L A/c	22,00,000	By S. Debtors	22,00,000

Costing P & L A/c

	Rs.		Rs.
To Cost of Sales A/c	18,05,000	By Sales A/c	22,00,000
„ P. OH control A/c (under-absorption)	80,000		
„ Net Profit (transferred to Reserve)	3,15,000		
	<u>22,00,000</u>		<u>22,00,000</u>

Trial Balance

	Dr	Cr.
Share Capital		Rs. 3,00,000
Reserve		5,15,000
S. Creditors		4,00,000
Plant & Machinery	Rs. 5,75,000	
S. Debtors	3,00,000	
Stock in hand	95,000	
Stock of Finished Goods	95,000	
„ Bank A/c	25,000	
„ W.I.P. A/c	1,25,000	
	<u>12,15,000</u>	<u>12,15,000</u>

Preparation of Ledger Accounts

Problem 45. Take On Jobs Ltd. has a good job order costing system and its accounting year closes on 30th June.

The following information is made available to you as on 1st June 1981 :—

	Dr. Rs.	Cr. Rs.
Raw Materials Inventory	30,000	
Work-in-Process	40,000	
Finished Goods	50,000	
Factory Overhead Control	3,75,000	
Cost of Goods Sold	16,00,000	
Factory Overhead Applied		3,90,000
Job Cost Sheets		
	Job L 20	Job X Job Y
	Rs.	Rs. Rs.
Direct Material	3,650	6,000 4,000
Direct Labour	7,000	5,000 5,000
Factory Overhead	3,850	2,750 2,750

The following transactions were completed during June :—

(i) Raw materials purchased Rs. 1,02,000.

(ii) Payroll costs are distributed as under :—

Factory Production Labour :	
Job L 20	Rs. 2,500
Job X	3,000
Job Y	2,500
	----- 8,000
Indirect labour	1,000
Sales salaries	4,000
Administration salaries	5,000

Total Payroll	Rs. 18,000

General overtime costs and other allowances work out to 9% of the total payroll.

(iii) An analysis of material requisitions shows the following :—

	Rs.
Job L 20	12,000
X	15,000
Y	18,000
	----- 45,000
Issues to Repairs and Maintenance	12,000

(iv) Depreciation on Factory equipment was Rs. 3,500 for June.

(v) Sundry factory expenses in June amounted to Rs. 4,200.

(vi) Factory overhead is applied to production at the rate of 55% of Direct Labour Cost.

(vii) Goods completed during June amount to Job L 20. All finished goods are to be valued at an average cost of Rs. 2'50 each

(viii) 30,000 units are sold during June at a sales value of Rs. 90,000.

(ix) On 30th June 1981, the amount of over-absorbed or under-absorbed Factory overhead is to be transferred to the Cost of Goods Sold Account.

(x) Sales during the year till the end of May amounted to Rs. 18,00,000.

You are required to complete the appropriate Ledger Accounts and arrive at the balances in the following as on 30th June 1981 :—

Raw Material Inventory

Work-in-Process

Finished Goods

You are also required to tally the Work-in-Process Balance with Job Cost Sheets and arrive at the profit for the year. (C.A., Final, May 1982)

Solution.

Take On Jobs Ltd.

Raw Material Inventory A/c

To Balance b/d	Rs. 30,000	By W.I.P. A/c	45,000
„ Gen. Led. Adj. A/c	1,02,000	„ F.O.H Control A/c	12,000
		„ Balance c/d	75,000
	1,32,000		1,32,000

Work-in-Process A/c

To Balance c/d	40,000	By F.G. A/c	30,375
„ Wages control A/c	8,000	„ Balance c/d	67,025
„ Raw Mat. Inventory A/c	45,000		
„ F.O. Applied A/c	4,400		
	97,400		97,400

Finished Goods A/c

To Balance b/d	Rs. 50,000	By Cost of Sales A/c	75,000
„ W.I.P. A/c	30,375	(30,000 units @ Rs. 2.50)	
		By Balance c/d	5,375
	80,375		80,375

Factory Overhead Control A/c

To Balance c/d	Rs. 3,75,000	By Factory O.H. Applied A/c	Rs. 3,97,320
„ Wages Control A/c	1,000		
„ Wages Control A/c	1,620		
„ S.L. Control A/c	12,000		
„ G.L. Adj. A/c (Depreciation)	3,500		
„ G.L. Adj (S. Exp)	4,200		
	3,97,320		3,97,320

Cost of Goods Sold A/c

To Balance b/d	16,00,000	By Costing P & L A/c	16,86,920
„ F. Goods A/c	75,000		
„ Adm. O.H. A/c	5,000		
„ Sales O.H. A/c	4,000		
„ F. O.H. Applied A/c	2,920		
	<u>16,86,920</u>		<u>16,86,920</u>

Factory O.H. Applied A/c

To Factory O.H. Control A/c	Rs. 3,97,320	By Balance	Rs. 3,90,000
		„ W.I.P. A/c	4,400
		„ Cost of Goods sold A/c (as given)	2,920
	<u>3,97,320</u>		<u>3,97,320</u>

Wages Control A/c

To Gen. Ledger Adj A/c	Rs. 18,000	By W.I.P. A/c	Rs. 8,000
„ Gen. Ledger Adj A/c	1,620	„ F. O. Control A/c	1,000
		„ Sales Adm. O.H. Control A/c	4,000
		„ Adm. O.H. Control A/c	5,000
		„ F.O.H. Control A/c	1,620
	<u>19,620</u>		<u>19,620</u>

Sales O.H. Control A/c

To Wages Control A/c	Rs. 4,000	By Cost of Good sold A/c	Rs. 4,000
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Adm. O.H. Control A/c

To Wages Control A/c	Rs. 5,000	By Cost of Goods Sold A/c	Rs. 5,000
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Costing P & L A/c

To Cost of Goods Sold A/c	16,86,920	By Gen. Led. Adj. A/c (Sales up to May)	18,00,000
„ General Ledger Adj. A/c (Profit)	2,03,080	„ Gen. Ledger Adj A/c (Sales in June)	90,000
	<u>18,90,000</u>		<u>18,90,000</u>

Job Cost Sheets

<i>Job L 20</i>	<i>As at 1-6-87</i>	<i>During June</i>	<i>Total</i>
D. Material	Rs. 3,650	Rs. 12,000	Rs. 15,650
D. Labour	7,000	2,500	9,500
F. Overhead	3,850	1,375	5,225
	<u>14,500</u>	<u>15,875</u>	<u>30,375</u>
<i>Job X</i>			
D. Material	Rs. 6,000	Rs. 15,000	Rs. 21,000
D. Labour	5,000	3,000	8,000
F. Overhead	2,750	1,650	4,400
	<u>13,750</u>	<u>19,650</u>	<u>33,400</u>
<i>Job Y</i>			
D. Material	Rs. 4,000	Rs. 18,000	Rs. 22,000
D. Labour	5,000	2,500	7,500
F. Overhead	2,750	1,375	4,125
	<u>11,750</u>	<u>21,875</u>	<u>33,625</u>
Balance in Work-in-Progress			
Job X	Rs. 33,400		
Job Y	33,625		
Total	<u>67,025</u>		

Note : It is presumed that this much overtime forms part of factory overhead

RECONCILIATION OF COST ACCOUNTS AND FINANCIAL ACCOUNTS

Problem 4-6 (Control Accounts including Reconciliation) The following figures have been extracted from the Cost Records of a manufacturing unit :—

Stores : Opening balance	Rs. 30,000
Purchases	1,60,000
Transfers from Work-in-Progress	80,000
Issues to Work-in-Progress	1,60,000
Issues to Repairs and Maintenance	20,000
Deficiencies found in stock taking	6,000

Work-in-Progress—

Opening balance	60,000
Direct wages applied	60,000
Overheads applied	2,40,000
Closing balance	40,000

Finished products : Entire output is sold at a profit of 10% on actual cost from Work-in-Progress.

Others : Wages incurred Rs. 70,000; Overhead incurred Rs. 2,50,000

Items not included in Cost Records : Income from investments Rs. 10,000 ; Loss on Sale of Capital Assets Rs. 20,000.

Draw up Stores Control Account, Work-in-Progress Control A/c, Costing Profit and Loss Account, Profit and Loss Account and Reconciliation Statement.

(I.C.W.A. Inter, December 1987)

Solution : Costing Books**Stores Control Account**

To Balance b/d	Rs. 30,000	By WIP Control A/c	Rs. 1,60,000
„ Purchases A/c	1,60,000	„ Production Overhead A/c*	20,000
„ WIP Control A/c	80,000	„ Shortage A/c	6,000
		„ Balance c/d	84,000
	<u>2,70,000</u>		<u>2,70,000</u>

* For Repairs and Maintenance

Work-in-Progress Control A/c

To Balance b/d	Rs. 60,000	By Stores Control A/c	Rs. 80,000
„ Stores Control A/c	1,60,000	„ Costing P & L A/c (Cost of Sales)	4,00,000
„ Direct wages applied	60,000	„ Balance c/d	40,000
„ Overhead applied	2,40,000		
	<u>5,20,000</u>		<u>5,20,000</u>

Costing Profit & Loss A/c

To WIP Control A/c		By Gen. Ledger Adj.	Rs.
		A/c—sales	
(Cost of Sales)	4,00,000	Cost of Sales	4,00,000
„ Stores Control A/c (Shortages)	6,000	Profit	40,000
„ G.L. Adjustment A/c	34,000		
	<u>4,40,000</u>		<u>4,40,000</u>

Production Overhead A/c

To Gen. Ledger Adj. A/c	2,50,000	By WIP A/c	2,40,000
„ Stores Control A/c	20,000	„ Balance c/d	30,000
	<u>2,70,000</u>		<u>2,70,000</u>

Wages Control A/c

To Gen. Ledger Adj. A/c	70,000	By WIP Control A/c	60,000
		„ Balance c/d	10,000
	<u>70,000</u>		<u>70,000</u>

Stores Shortage A/c

By Stores Control A/c	6,000	By Costing P & L A/c	6,000
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Financial Books**Profit & Loss A/c**

To Opening Stock		By Sales A/c	4,40,000
—Stores	30,000	„ Closing Stock	
—WIP	60,000	—Stores	84,000
	<u>90,000</u>	—WIP	40,000
„ Purchases	1,60,000		<u>1,24,000</u>
„ Wages incurred	70,000	„ Income from investment	10,000
„ Overheads incurred	2,50,000	„ Loss	16,000
„ Loss on Sale of capital Assets	20,000		
	<u>5,90,000</u>		<u>5,90,000</u>

Reconciliation Statement

Profit as per costing records	Rs. 34,000
Less : Under-absorbed wages	10,000
Under-absorbed overheads	<u>40,000</u>
	(-) 6,000
Items not included in cost accounts :	
Add : Income from investment	<u>10,000</u>
	(+) 4,000
Less : Loss on Sale of Capital Assets	<u>(-) 20,000</u>
Loss as per financial accounts	<u>(-) 16,000</u>

Problem 4.6(a). (Reconciliation Statement). The profit and loss account of Oil India (Pvt.) Ltd. for the year ended 31st March, 1987 is as follows :

To Materials	Rs. 4,80,000	By Sales	Rs. 9,60,000
„ Wages	3,60,000	„ Closing stock	1,80,000
„ Direct expenses	2,40,000	„ Work-in-progress :	
„ Gross profit	1,20,000	Materials	30,000
		Wages	18,000
		Direct expenses	12,000
			60,000
	<u>12,00,000</u>		<u>12,00,000</u>
To Administration expenses	60,000	By Gross profit	1,20,000
„ Net profit	60,000		
	<u>1,20,000</u>		<u>1,20,000</u>

As per the cost records the direct expenses have been estimated at a cost of Rs. 30 per kg. and administration expenses at Rs. 15 per kg. The profit as per the costing records are Rs. 1,10,400. During the year 6,000 kgs. were manufactured and 4,800 kgs. were sold.

Prepare a statement of costing profit and loss account and reconcile the profit with financial records. (C.S. Inter, December 1987)

Solution. Statement showing profit as per cost accounts

Materials (Purchased)	Rs. 4,80,000	
Less : W.I.P.	30,000	4,50,000
Wages	Rs. 3,60,000	
Less : W.I.P.	18,000	3,42,000
Direct Expenses $6,000 \times \text{Rs. } 300$		1,80,000
Adm. Exp. $6,000 \times 15$		90,000
Cost of production—6,000 units		<u>10,22,000</u>
Less : Closing Stock—12,000 units		
(Rs. $10,62,000/6,000 \times 1,200$)		2,12,400
Cost of goods sold—4,800 units		<u>8,49,600</u>
Sales		9,60,000
Profit as per cost records		<u>1,10,400</u>

Reconciliation Statement

Profit as per Cost Account		Rs. 1,10,400
Adm. Exp. over charged in Cost Accounts (Rs. 90,000—Rs. 60,000)		30,000
		<hr/>
		1,40,400
Less : Over valuation of closing stock (Rs. 2,12,400—Rs. 1,80,000)	32,400	
Less : Direct expenses under- recovered in Cost Accounts (Rs. 2,28,000—Rs. 1,80,000)	48,000	80,400
	<hr/>	<hr/>
Profit as per Profit and Loss Account		60,000
		<hr/>

When only financial profit is given

Problem 47. During the year ended 31st January, 1986 the profit of a Company as per Financial Profit and Loss A/c, was Rs. 33,248 as given below. Prepare a reconciliation statement and arrive at the profit as per Cost Accounts using the additional information given.

Profits and Loss A/c for the year ended 31st January, 1986.

To Opening Stock	Rs. 4,94,358	By Sales	Rs. 6,93,000
„ Purchases	1,64,308	By Sundry Income	632
	<hr/>		<hr/>
	6,58,666		6,93,632
Less Closing Stock	1,50,242		
	<hr/>		<hr/>
	5,08,424		
To Direct Wages	46,266		
„ Factory Overhead	41,652		
„ Administration expenses	19,690		
„ Selling Expenses	44,352		
„ Net Profit	33,248		
	<hr/>		<hr/>
	6,93,632		6,93,632
	<hr/>		<hr/>

The Costing Records show :

(i) Closing Stock	Rs. 1,56,394
(ii) Direct Wages absorbed	49,734
(iii) Factory Overheads absorbed	39,428
(iv) Administration expenses calculated at 3% of sales.	

Solution : Reconciliation Statement for the year ended 31st Jan 1986.

First of all, from the additional information given, it is necessary to find out impact on costing P&L A/c.

<i>Particulars</i>	<i>Financial Book</i>	<i>Cost Books</i>	<i>Impact on Cost Books</i>
Closing Stock	Rs. 1,50,242	Rs. 1,56,394	Rs. 6,152 It will result in more profit
Sundry income	632		632 Less profit in cost accounts
Direct wages	46,266	49,734	3,468 Overabsorbed
Factory overhead	41,652	39,428	2,224 Underabsorbed
Admn. expenses	19,690	20,790	1,100 Overabsorbed
Selling expenses	44,352	34,650	9,702 Under-absorbed

Note. From financial profit, we have to arrive at the cost profit. Excess valuation of closing stock in cost books. will result in more profit as per cost books. Therefore the different in valuation of closing stock will be *added* to financial profit. All under-absorbed items will be added and over-absorbed will be subtracted from financial profit.

Profit as per financial P & L A/c		Rs. 33,248
<i>Add :</i> Difference in closing stock	6,152	
Factory overheads underabsorbed	2,224	
Selling expenses underabsorbed	9,702	
	<hr/>	18,078
<i>Less :</i> Overabsorbed direct wages	3,468	51,326
Overabsorbed admn. expenses	1,100	
Sundry income not taken in cost accounts	632	5,200
	<hr/>	<hr/>
Profit as per cost Accounts		46,126

When profits are not given

Problem 48. The financial records of Modern Manufacturers Ltd. reveal the following for the year ended 30-6-1986 :

	<i>Rs. in thousands</i>
Sales (20,000 units)	Rs. 4,000
Materials	1,600
Wages	800
Factory Overheads	720
Office and Administrative Overheads	416
Selling and Distribution Overheads	288
Finished Goods (1,230 units)	240

Work-in-Progress :

Materials	48	
Labour	32	
Overheads (Factory)	32	
	<hr/>	112
Goodwill written off		320
Interest on Capital		32

In the Costing Records, factory overhead is charged at 100% wages, administration overhead 10% of factory cost and selling and distribution overhead at the rate of Rs. 16 per unit sold.

Prepare a statement reconciling the profit as per cost records with the profit as per financial records of the company.

(C.A. Inter., Nov. 1986 ; May 1985 Modified)

Solution. First of all it is necessary to find out profit as per financial accounts and as per cost accounts.

**Profit & Loss A/c of Modern Manufacturers
Ltd. for the year ended 30th June, 1986 (Rs. '000)**

<i>Dr.</i>			<i>Cr.</i>
To Materials	Rs. 1,600	By Sales (20,000 units)	Rs. 4,000
„ Wages	800	„ Closing Stock	
„ Factory overheads	720	„ Finished Stock	
„ Office & admn. overheads	416	(1,230 units)	240
„ Selling & distribution overhead	288	„ W.I.P.	112
„ Goodwill written off	320		
„ Interest on capital	32		
„ Net profit	176		
	<hr/>		<hr/>
	4,352		4,352

Profit as per cost accounts

	<i>Rs. '000</i>
Materials	1,600.00
Wages	800.00
	<hr/>
Prime cost	2,400.00
Factory overheads (100% of wages)	800.00
	<hr/>
Factory cost (Gross)	3,200.00
<i>Less</i> Closing W.I.P.	112.00
	<hr/>
Factory cost (21,230 units)	3,088.00
Office and admn. overheads (10% of Fy. cost)	308.80
	<hr/>
Total cost of production	3,396.80
<i>Less</i> Closing Stock (Finished Goods)	196.80*
	<hr/>
Cost of production of 20,000 units	3,200.00
Selling & Distribution overhead @ Rs. 16 per unit	320.00
	<hr/>

Cost of Sales	3,520'00
Sales realisation for 20,000 units	4,000'00
Profit	480'00
	=====

*Total cost of production (Rs. 33,96,800) ÷ Total number of units produced (21,230 units, i.e., units sold plus closing stock of finished goods) = Rs. 160 per unit. Cost of 1230 units = $1230 \times 160 = \text{Rs. } 1,96,800$.

Statement reconciling the profit as per cost accounts and the profit as per financial accounts

	Rs. '000	Rs. '000
Profit as per cost accounts		480'00
<i>Add</i> Over-absorbed overheads :		
Factory overheads (800—720)	80'00	
Selling & Distribution overhead (320—288)	32'00	
Overvalued closing stock in financial accounts (240—196'80)	43'20	
	<hr/>	155'20
		<hr/>
		635'20
<i>Less</i> Underabsorbed office & administration Overhead (416—308'80)	107'20	
Goodwill debited in financial accounts only	320'00	
Interest of capital charged in financial accounts	32'00	
	<hr/>	459'20
		<hr/>
		176'00
		=====

Preparation of cost of production/sales and reconciliation of profits

Problem 49. The following figures for the year 1984 have been extracted from the books of a manufacturing concern :

Sales	Rs. 50,000	Work-in-Progress in hand :	Rs.
Direct Labour	20,000	Direct Labour	600
Direct Material	10,000	Direct Material	400
Factory Overhead Expenses	9,500	Factory overheads	300
Administration Overhead	5,200		
Selling & Distribution Overhead	3,800		<hr/>
			1,300
		Finished Stock in hand	2,700
		Goodwill written off	1,500
		Interest on Capital	500

Cost Accounts Manual states that the Factory Overhead is to be charged at 50% of direct labour wages. Administration Overhead at 10% of Works Cost and Selling and Distribution overhead @ Re. 1 per unit sold.

The units of product sold and in hand were 4,000 and 257 respectively :

- Find out the cost of production and the cost of sales per unit of product.
- Prepare a statement to reconcile the costing profit and loss with the profit/loss exhibited in the financial accounts.

(I.C.W.A. Inter, June 1985)

Solution.

Financial Accounts
P & L A/c of the year 1984

To Direct Material	Rs. 10,000	By Sales	Rs. 50,000
„ Direct Labour	20,000	„ C/Stock	
„ Factory overhead	9,500	„ W.I.P.	Rs. 1,300
„ Adm. O.H.	5,200	F. Goods	2,700
„ S & D O.H.	3,800		4,000
„ Goodwill written off	1,500		
„ Int. on capital	500		
„ Net Profit	3,500		
	<u>54,000</u>		<u>54,000</u>

(a) Statement of Cost and Sales

Material	Rs. 10,000
Direct Labour	20,000
Prime-Cost	30,000
Factory Overhead (50% of D. Labour)	10,000
Factory Cost	40,000
Less C/W.I.P.	(1,300)
Factory Cost of 4257 units	38,700
Administration Overhead (10% of works cost or factory cost)	3,870
Cost of production of 4257 unit	42,570
Less closing stock	2,570*
*(Rs. 42,570 ÷ 4257) × Rs. 257	
Cost of goods sold (4000 units)	40,000
S & D Overhead (4,000 × Re. 1)	4,000
Cost of Sales of 4000 units	44,000
Profit	6,000
Sales	<u>50,000</u>

Reconciliation Statement

Profit as per Cost Accounts	Rs. 6,000	
<i>Add :</i> (i) Factory overhead overabsorbed in cost accounts, i.e., Rs. 10,000—Rs. 9,500	Rs. 500	
(ii) Selling overhead overabsorbed in cost accounts (Rs. 4,000—Rs. 3,800)	200	
(iii) Closing Stock of Finished goods less valued in cost accounts (Rs. 2,700—Rs. 2,570)	130	830
		<u>6,830</u>
<i>Less :</i> (i) Adm. overhead underabsorbed in cost accounts (Rs. 5,200—Rs. 3,870)	1,330	
(ii) Goodwill written off shown in Financial accounts but not in cost statements	1,500	
(ii) Interest on capital shown in Financial accounts but not in cost accounts	500	3,330
		<u>3,500</u>
Profit as per financial accounts		<u>==</u>

Computation of profit as per cost accounts and its reconciliation with financial accounts

Problem 410. M/s. S.V. Ltd., has furnished you the following information from the financial books for the year ended 30th June, 1980.

Profit and Loss Account
(for the year ended 30th June, 1980)

Opening Stock :	Rs.	Sales :	Rs.
500 units at Rs. 35 each	17,500	10,259 units	7,17,500
Materials consumed	2,60,000	Closing stock :	
Wages	1,50,000	250 units at Rs. 50	
Gross profit c/d	3,02,500	each	12,500
	<u>7,30,000</u>		<u>7,30,000</u>
Factory overheads	94,750	Gross profit b/d	3,02,500
Administration overheads	1,06,000	Interest	250
Selling expenses	55,000	Rent received	10,000
Bad debts	4,000		
Preliminary expenses	5,000		
Net profit	48,000		
	<u>3,12,750</u>		<u>3,12,750</u>

The cost sheet shows the cost of materials as Rs. 26 per unit and the labour cost Rs. 15 per unit. The factory overheads are absorbed at 60% of labour cost and administration overheads at 20% of factory cost.

Selling expenses are charged at Rs. 6 per unit. The opening stock of finished goods is valued at Rs. 45 per unit.

You are required to prepare :

(i) A statement showing profit as per cost accounts for the year ended 30th June, 1980.

(ii) A statement showing the reconciliation of profit disclosed in cost accounts with the profit shown in financial accounts.

[C.A. Inter (N.S.), November 1980]

Solution. (i) Statement of Profit as per Cost Accounts

	Units	Rs.
Opening stock @ Rs. 45 per unit	500	22,500
Cost of production @ Rs. 60 (See Note 1)	10,000	6,00,000
Total	10,500	6,22,500
Less : Closing stock @ Rs. 60 per unit	250	15,000
Cost of production of goods sold	10,250	6,07,500
Selling expenses @ Rs. 6 per unit		61,500
Cost of sales		6,69,000
Profit		48,500
Sales	10,250	7,17,500

Reconciliation Statement

	(+)	(-)
	Rs.	Rs.
Profit as per cost accounts	Rs. 48,500	
Less : Under-recovery of overheads in cost accounts :		
Factory overheads	Rs. 4,750	
Administration overheads	6,000	10,750
Add : Over-recovery of selling overheads in cost accounts	6,500	
Add : Over-valuation of opening stock in cost accounts	5,000	
Less : Over-valuation of closing stock in cost accounts		2,500
Add : Income excluded from cost accounts :		
Interest	Rs. 250	
Rent	10,000	10,250
Less : Expenses excluded from cost accounts :		
Bad debts	Rs. 4,000	
Preliminary expenses	5,000	9,000
	70,250	22,250
Profit as per Financial Accounts	48,000	

Working Notes

1.

Statement of Cost (10,000 units)

		(Cost per unit)
Materials	Rs. 2,60,000	Rs. 26'00
Labour	1,50,000	15'00
Factory overheads, 60% of Labour Cost	90,000	9'00
Factory Cost	5,00,000	50'00
Administration overheads, 20% of factory cost	1,00,000	10'00
Total Cost	6,00,000	60'00

2. **Statement of differences between the two sets of accounts**

	Financial Accounts	Cost Accounts	Difference	Remarks
	Rs.	Rs.	Rs.	
Factory overhead	Rs. 94,750	90,000	4,750	Under-recovery
Admn. overhead	1,06,000	1,00,000	6,000	Under-recovery
Selling expenses	55,000	61,500	6,500	Over-recovery
Opening stock	17,500	22,500	5,000	Over-valuation
Closing stock	12,500	15,000	2,500	Over-valuation

Problem 4-11.(Reconciliation Statement). The profit and loss account of Oil India (Pvt.) Ltd. for the year ended 31st March, 1987 is as follows :

To Materials	Rs. 4,80,000	By Sales	Rs. 9,60,000
„ Wages	3,60,000	„ Closing stock	1,80,000
„ Direct expenses	2,40,000	„ Work-in-progress :	
„ Gross profit	1,20,000	Materials	30,000
		Wages	18,000
		Direct expenses	12,000
			60,000
	12,00,000		12,00,000
To Administration expenses	60,000	By Gross profit	1,20,000
„ Net profit	60,000		
	1,20,000		1,20,000

As per the cost records the direct expenses have been estimated at a cost of Rs. 30 per kg. and administration expenses at Rs. 15 per kg. The profit as per the costing records are Rs. 1,10,400. During the year 6,000 kgs. were manufactured and 4,800 kgs. were sold.

Prepare a statement of costing profit and loss account and reconcile the profit with financial records.

(C.A. Inter, December 1987)

Solution. Statement showing profit as per cost accounts

Materials (Purchased)	Rs. 4,80,000	
Less : W.I.P.	<u>30,000</u>	4,50,000
Wages	Rs. 3,60,000	
Less : W.I.P.	<u>18,000</u>	3,42,000
Direct Expenses 6,000 × Rs. 300		1,80,000
Adm. Exp. 6,000 × 15		<u>90,000</u>
Cost of production—6,000 units		10,62,000
Less : Closing Stock—12,000 units		
(Rs. 10,62,000/6,000) × 1,200		<u>2,12,400</u>
Cost of goods sold—4,800 units		8,49,600
Sales		<u>9,60,000</u>
Profit as per cost records		<u>1,10,400</u>

Reconciliation Statement

Profit as per Cost Account	Rs. 1,10,400
Adm. Exp. over charged in Cost Accounts (Rs. 90,000—Rs. 60,000)	<u>30,000</u>
	1,40,400

Less : Over valuation of closing stock		
(Rs. 2,12,400—Rs. 1,80,000)	32,400	
Less : Direct expenses under-		
recovered in Cost Accounts		
(Rs. 2,28,000—Rs. 1,80,000)	<u>48,000</u>	80,400
Profit as per Profit and Loss Account		<u>60,000</u>

Authors' Special Notes

1. Transfer Administration Overhead to F/Goods A/c and Selling and Distribution Overhead to cost of sales account, if nothing specific is given.
2. Note the use of idea 'missing values' in cost book-keeping (Problem A 26—recent trend.)
3. Refer to Problem A 4 and note (i) prepaid production overhead as opening balance (ii) recorded non-productive time of direct workers to be treated as overheads and (iii) stock gain in WIP to be taken to P & L A/c.

BREAK-UP OF THE PROBLEMS RELATING TO COST BOOK-KEEPING ACCORDING TO DIFFERENT LEVELS (FOR PROBLEMS WITH PREFIX A, REFER TO APPENDIX A)

Intermediate Level

Control Accounts—P 4·1, 4·4, 4·6, A 4, A 26, A 67

Reconciliation—P 4·6(a), 4·7, 4·8, 4·9, 4·10, 4·11, A151, A159

Final Level

Control Accounts—P 4·2, 4·3, 4·5.

Please also refer to the Examples 5·1 to 5·13 of the book "Advanced Cost and Management Accounting—Text" by Saxena and Vashist.

Unit Costing, Job Costing and Contract Costing

[Cost Sheet 5.1—5.8; Production Account 5.9—5.10; Job Costing 5.11—5.19; Contract Costing 5.20—5.24 ; Escalation Clauses 5.25—5.27]

Computation of factory cost by charging overhead as a % Labour and Prime cost

Problem 5.1. The standard production for a particular work order is 20 units per day and piece-rate wages is 60 paise per unit if daily production is 20 units or more. The rate is 50 paise per unit if production is less than 20 units. Cost of material is 30 paise per unit. It is proposed to charge factory overheads under one of the following methods :—

- (i) 100% on Labour Cost.
- (ii) 80% on Prime Cost.

Tabulate the above data in the form of a suitable statement and indicate the factory cost per unit, under each of the above methods, if the daily production is (a) 15 units (b) 20 units (c) 25 units.

(I.C.W.A. Inter, June '86 R.S.)

Solution. (i) Statement showing factory cost per unit by charging overheads at 100% on Labour Cost.

Production per day (units)	15	20	25
Material cost @ 30 paise per unit	Rs. 4.50	Rs. 6.00	Rs. 7.50
Labour cost @ 50 paise for 15 units and @ 60 paise for 20 and 25 units	7.50	12.00	15.00
Prime cost	12.00	18.00	22.50
Factory overheads @ 100% on labour cost	7.50	12.00	15.00
Total Factory Cost	19.50	30.00	37.50
Factory cost per unit (Factory cost ÷ Production)	1.30	1.50	1.50

(ii) Statement showing factory cost per unit by charging overheads at 80% of Prime cost.

Production per day (units)	15	20	25
Prime cost as at (i) above	Rs. 12'00	Rs. 18'00	Rs. 22'50
Factory overheads @ 80% of Prime cost	9'60	14'40	18'00
Total factory cost	21'60	32'40	40'50
Factory cost per unit	1'44	1'62	1'62

Condensed Profit & Loss Account

Problem 5'2. The following figures are extracted from the Trial Balance of Gogetter Company on 30th September, 1986 :

Inventories :	Rs.	Rs.
Finished Stock	80,000	
Raw Materials	1,40,000	
Work-in-Process	2,00,000	
Office Appliances	17,400	
Plant & Machinery	4,60,500	
Buildings	2,00,000	
Sales		7,68,000
Sales Return and Rebates	14,000	
Materials Purchased	3,20,000	
Freight incurred on Materials	16,000	
Purchase Returns		4,800
Direct Labour	1,60,000	
Indirect Labour	18,000	
Factory Supervision	10,000	
Repairs and Upkeep--Factory	14,000	
Heat, Light and Power	55,000	
Rates and Taxes	6,300	
Miscellaneous Factory Expenses	18,700	
Sales Commission	33,600	
Sales Travelling	11,000	
Sales Promotion	22,500	
Distribution Deptt.—Salaries and Expenses	18,000	
Office Salaries and Expenses	2,600	
Interest on Borrowed Funds	2,000	

Further details are available as follows :

(i) Closing inventories :

Finished Goods	1,15,000
Raw Materials	1,80,000
Work-in-Process	1,92,000

(ii) Accrued expenses on :

Direct Labour	8,000
Indirect Labour	1,200
Interest on Borrowed Funds	2,000

- (iii) Depreciation to be provided on :
 Office Appliances 5%
 Plant and Machinery 10%
 Buildings 4%
- (iv) Distribution of the following costs :
 Heat, Light and Power to Factory, Office and Distribution in the ratio 8 : 1 : 1.
 Rates and Taxes two-thirds to Factory and one-third to Office.
 Depreciation on Buildings to Factory, Office and Selling in the ratio 8 : 1 : 1.
- With the help of the above information, you are required to prepare a condensed Profit and Loss Statement of Gogetter Co. for the year ended 30th September, 1986 along with supporting schedules of :

(i) Cost of Sales.

(ii) Selling and Distribution Expenses.

(iii) Administration Expenses.

(C.A. Inter, Nov. 1986)

Solution.		Cost of sales	
Materials purchased		Rs. 3,20,000	
Less Returns		4,800	
Materials net of return		3,15,200	
Add Freight		16,000	
Opening R.M. Stock		1,40,000	
		4,71,200	
Less Closing R.M. Stock		1,80,000	
R.M. Consumed			Rs. 2,91,200
Direct labour	1,60,000		
Add Accrued expenses	8,000		1,68,000
Prime Cost			4,59,200
Factory overhead :			
Indirect labour	18,000		
Accrued expenses	1,200		
		19,200	
Factory supervision		10,000	
Repairs and upkeep		14,000	
Heat, light and power		52,000	
Rates and Taxes		4,200	
Misc. factory expenses		18,700	
Depreciation : Plant	46,050		
Building	6,400	52,450	1,70,550
Works Cost (Gross)			6,29,750
Opening W.I.P.	2,00,000		
Less Closing W.I.P.	1,92,000		8,000
Works Cost (Net)			6,37,750

<i>Admin. Overheads :</i>		
Heat, light and power	6,500	
Rates and taxes	2,100	
Depreciation : Building	800	
Office appliances	870	
Office salaries and expenses	8,600	18,870
		<hr/>
Total cost		6,56,620
Add Opening Finished Stock		80,000
		<hr/>
		7,36,620
Less Closing Finished stock		1,15,000
		<hr/>
Cost of production of saleable units		6,21,620
<i>Selling and Distribution Expenses :</i>		
Heat and light	6,500	
Depreciation Building	800	
Sales Commission	33,600	
Sales travelling	11,000	
Sales promotion	22,500	
Distribution Deptt. expenses	18,000	92,400
		<hr/>
Cost of Sales		7,14,020
		<hr/>

Geotter Company Ltd.
Condensed P & L Statement
(for the year ended 30th Sept. 1986)

To Cost of Sales	7,14,020	By Sales	7,68,000
„ Int. on borrowed funds	4,000	Less Sales returns	14,000
„ Net Profit	35,980		<hr/>
			7,54,000
	<hr/>		<hr/>
	7,54,000		7,54,000

Computation of different elements of cost when factory overheads are apportioned by giving weightage to production

Problem 53 X Ltd. manufactures four brands of toys—A, B, C and D. If the company limits the manufacture to just one brand the monthly production will be :

A—50,000 units

B—1,00,000 units

C—1,50,000 units

D—3,00,000 units

You are given the following set of information from which you are requested to find out the profit or loss made on each brand showing clearly the following elements :

(a) Direct Cost ; (b) Works Cost ; (c) Total Cost.

Brands

	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>
Actual production (units)	6,750	18,000	40,500	94,500
Direct Wages (Rs.)	15,000	27,500	37,500	1,05,000
Direct Material Cost (Rs.)	50,000	92,500	1,27,500	3,80,000
Selling Price per unit (Rs.)	20	15	10	8

Factory Overhead expenditure for the month was Rs. 1,62,000. Selling and distribution cost should be assumed @ 20% of Works cost. Factory Overhead expenses should be allocated to each brand on the basis of units which could have been produced in a month when single brand production was in operation.

(I.C.W.A. Inter, Dec., 1984 ; June 1983—Modified)

Solution. It is given in the problem that factory overhead should be allocated to each brand of toys on the basis of units which could have been produced in a month when single brand production was in operation. If the company limits the production to just one brand, the monthly production will be :

A—50,000 units ;

B—1,00,000 units

C—1,50,000 „

D—3,00,000 „

Now, suppose the total machine hours available are 3,00,000. Therefore, production per machine hour will be : *A*—6 units ; *B*—3 units ; *C*—2 units and *D*—1 unit. For the purpose of factory overhead allocation, these weights will have to be multiplied with actual production :

	<i>Weights</i>	<i>Actual production</i>	<i>Weighted production</i>
<i>A</i>	6	6,750	40,500
<i>B</i>	3	18,000	54,000
<i>C</i>	2	40,500	81,000
<i>D</i>	1	94,500	94,500
			2,70,000

Factory overhead recovery rate for *D* = $\frac{\text{Factory overhead}}{\text{Weighted production}}$ = $\frac{\text{Rs. 1,62,000}}{2,70,000}$ or Re. 0.60

Overhead recovery rate and factory overhead allocated to each brand will be :

		<i>Production</i>	<i>Factory Overhead</i>
<i>A</i>	Re. 0.60 × 6	= Rs. 3.60 × 6,750	Rs. 24,300
<i>B</i>	Re. 0.60 × 3	= Rs. 1.80 × 18,000	32,400
<i>C</i>	Re. 0.60 × 2	= Rs. 1.20 × 40,500	48,600
<i>D</i>	Re. 0.60 × 1	= Re. 0.60 × 94,500	56,700
			1,62,000

Statement showing the profitability of each brand

	A	B	C	D
Direct material	Rs. 50,000	Rs. 92,500	Rs. 1,27,500	Rs. 3,80,000
Direct wages	15,000	27,500	37,500	1,05,000
Direct cost	65,000	1,20,000	1,65,000	4,85,000
Factory overhead	24,300	32,400	48,600	56,700
Works cost	89,300	1,52,400	2,13,600	5,41,700
Selling and distribution (20% of works cost)	17,860	30,480	42,720	1,08,340
Total cost of sales	1,07,160	1,82,880	2,56,320	6,50,040
Sales	1,35,000	2,70,000	4,05,000	7,56,000
Profit	27,840	87,120	1,48,680	1,05,960

Comprehensive Statement of Cost

Problem 54 From the following balances extracted at 31st March 1983, prepare accounts in such form as to ascertain :

(a) Prime Cost ; (b) Works Cost of manufactured goods ; (c) Gross profit on manufacture ; (d) Gross profit on sales ; (e) Net profit ; (f) Percentage of Net Profit to Sales.

Stocks on 1-4-82	Rs.		Rs.
Manufactured goods	97,000	Office Salaries	94,000
Raw materials	30,000	Coal	57,900
Depreciation on Plant		Carriage in	39,100
& Machinery	1,30,000	Carriage out	23,300
Discount allowed	37,400	General expenses	31,700
Printing & Stationery	9,300	Factory Rent & Rates	2,27,100
Purchase-Manufactured		Office Rent & rates	65,000
goods	1,27,400	Manufacturing	
Raw materials	8,72,600	Salaries & Wages	11,02,900
Debtors	2,17,400	Travelling expenses	27,900
Cash at Bank	17,100	Sales	29,94,200
Repairs of Machinery	25,000	Creditors	2,17,900
Capital	7,78,200		

Stocks on 31st March 1983 were:—Manufactured goods Rs. 2,79,400 ; raw materials Rs. 20,000 ; goods manufactured are to be debited to the Sales department at current market price, viz., Rs. 27,15,000.

(ICWA Final, June 1983)

Solution. Manufacturing Account*(for the period ending 31st March 1983)*

To Opening stock of raw material	Rs. 30,000	By Goods manufactured debited	
Add Purchases of raw material	8,72,600	to Sales Deptt. at Current Market prices	27,15,000
	9,02,600		
Less : Closing stock of raw material	20,000		
Raw Material Consumed	8,82,600		
To Carriage inward	39,100		
„ Mfg. Wages	11,02,900		
(a) Prime Cost	20,24,600		
„ Depreciation on Plant and Machinery	1,30,000		
„ Repairs to Machinery	25,000		
„ Coal	57,900		
„ Factory rent and taxes	2,27,100		
(b) Works Cost of Manufactured Goods	24,64,600		
(c) Gross Profit on manufacture	2,50,400		
	27,15,000		27,15,000

Trading Account*(for the year ending 31st March 1983)*

To Opening Stock of Manufactured goods	Rs. 97,400	By Sales	29,94,200
„ Cost of Goods Manufactured during the period	27,15,000		
„ Purchase of Manufactured goods	1,27,400		
	29,39,800		
Less : Closing Stock of Manufactured goods	2,79,400		
	26,60,400		
„ (a) Gross Profit	3,33,800		
	29,94,200		29,94,200

Profit and Loss Account
(for the period ending 31st March 1983)

To Office Salaries	Rs. 94,000	By Gross Profit on	
„ Office rent and tax	65,000	Sales	3,33,800
„ Travelling exp.	27,900	„ Gross Profit on	
„ Printing and stationery	9,300	Manufacture	2,50,400
„ Carriage outward	23,300		
„ G. expenses	31,700		
„ Discount Allowed	37,400		
(e) Net Profit	2,95,600		
	5,84,200		5,84,200

(f) Percentage of Net Profit to Sales

$$= (\text{Rs. } 2,95,600 \div 29,94,200) \times 100 = 9.87\%$$

Preparation of a batch cost sheet when profit is fixed as a % of sales

Problem 5.5. Allplay and Nowork Ltd. are specialists in the manufacture of sports goods. They manufacture croquet mallets but purchase the wooden balls, iron arches and stakes required to complete a croquet set.

Mallets consist of a head and handle. Handles use 1.5 board feet per handle at Rs. 40 per board foot. Spoilage loss is negligible for manufacture of handles.

Heads frequently split and create considerable scrap. A head requires 0.20 board feet of high quality lumber costing Rs. 70 per board foot. Spoilage normally works out to 20% of the completed heads. 4% of the spoiled heads can be salvaged and sold as scrap at Rs. 10 per spoiled head.

In the department machining and assembling the mallets, 12 men work 8 hours per day for 25 days in a month. Each worker can machine and assemble 15 mallets per uninterrupted 50 minutes time frame. In each 8 hour working day, 15 minutes are allowed for coffee-break, 8 minutes on an average for training and 9 minutes for supervisory instructions. Besides 10% of each day is booked as idle time to cover checking in and checking out, changing operations, getting materials and other miscellaneous matters. Workers are paid at a comprehensive rate of Rs. 6 per hour.

The department is geared to produce 40,000 mallets per month and the monthly expenses of the department are as under. —

Finishing and painting the mallets	Rs. 50,800
Lubricating oil for cutting machines	300
Depreciation for cutting machines	700
Repairs and maintenance	100
Power to run the machines	200
Plant Manager's salary	2,700
Other overheads allocated to the department	1,20,000

As the mallets are machined and assembled in lots of 500, prepare a total cost sheet for one lot and advise the management on the selling price to be fixed per mallet in order to ensure a minimum of 20% margin on the selling price (C.A. Final, Nov. 1983)

Solution. Allplay and Nowork Ltd.

Cost sheet of one lot of 500 croquet mallets

<i>Direct Material :</i>			
Handles ($1.5 \times 500 \times \text{Rs. } 40$) ...	Rs. 30,000		
Heads ($1.2 \times 500 \times 0.20 \times \text{Rs. } 70$)			
(Refer to Note 1)	Rs. 8,400		
<i>Less : Scrap</i>			
(4% of $100 \times \text{Rs. } 10$)	40		
	<u>8,360</u>		38,360
<i>Direct Labour : (Note 2)</i>			
8 Hrs. $\times \text{Rs. } 6/120 \times 500$			200
			<u>38,560</u>
<i>Prime Cost</i>			
<i>Factory and other overheads :</i>			
Variable : Finishing Rs. $50,800/40,000 \times 500$			635
(Note No. 3)			
Fixed. $1,24,000/36,000 \times 500$			1,722
			<u>40,917</u>
Total Cost			
<i>Price Quotation :</i>			
Cost : Rs. $40,917 \div 500$		Rs. 81.834	
Profit 20% of S. Price or 25% of Cost		20.458	
Selling price			<u>102.292</u>

Working Note.

- 1 unit of output of head requires 1.20 unit of input.
 \therefore Total head processed = $1.20 \times 500 = 600$ of which 100 head, i.e., 20% of output 500 are spoiled.
2. Total time in a day - 8 hrs. $\times 60 =$ 480 Minutes
Less time not utilized

Coffee break	15 Minutes
Training	8 Minutes
Supervisory Instruction	9 Minutes
Idle time (10%)	48 Minutes
	<u>80 Minutes</u>

400 Minutes

\therefore Mallet output each worker per day
 $= 400/50 \times 15 = 120$ Mallets.

3. It is assumed that cost of finished and painting the mallet is variable to production of 40,000 Mallets per month.
4. Total production during the month
 $120 \text{ mallets} \times 12 \text{ Men} \times 25 \text{ days} = 36,000 \text{ Mallets}$
5. All other expenses are to be borne by output of 36,000 Mallets.

Computation of cost sheet when standard margin is fixed as a % of cost of sales

Problem 5.6. Mr. Rohit has a small furniture factory. He specialises in the manufacture of small dining tables of standard size of which he can make 15,000 a year. The cost per table worked out as under for the year 1980-81, when he made and sold 10,000 tables.

Materials	Rs. 30
Labour	10
Overhead (fixed) recovered @ 50% of material cost	15
	<hr/> 55

Price are fixed by adding a standard margin of 10% to the total cost arrived at as above.

In 1981-82 due to fall in the cost of materials, total cost worked out as under :

Materials	Rs. 20
Labour	10
Overhead recovered @ 50% of material cost	10
	<hr/> 40

Mr. Rohit maintained his standard margin of 10% on the cost of sales. Sales were at the same level as in 1980-81. You are asked to :

- (a) Determine profit or loss for the year 1981-82.
- (b) Compute the price which should have been charged in 1981-82 to yield the same profit or loss as in 1980-81.

(I.C.W.A Inter, Jun 1983)

Solution.

(a)

Statement showing the Profit
(for the year 1980-81)

Production and sale	10,000 tables	
	Total	Per unit
Materials ($30 \times 10,000$)	Rs. 3,00,000	Rs. 30.00
Labour ($10 \times 10,000$)	1,00,000	10.00
Prime cost	4,00,000	40.00
Overhead (50% on materials)	1,50,000	15.00
Total cost	5,50,000	55.00
Profit (10% of total cost)	55,000	5.50
Selling price	6,05,000	60.50

**Statement showing the profit or loss
for the year 1981-82**

		<i>10,000 tables</i>	
<i>Production</i>		<i>Total</i>	<i>Per unit</i>
Total cost as given ($40 \times 10,000$)		Rs. 4,00,000	Rs. 40.00
Profit @ 10%		40,000	4.00
Selling price		4,40,000	44.00
Revised total cost treating overhead as fixed charge :			
Materials	2,00,000		
Labour	1,00,000		
Overhead	1,50,000	4,50,000	45.00
Loss		10,000	1.00

**(b) Computation of price to be charged in 1981-82 to
yield the same profit as in 1980-81**

Cost	Rs. 4,50,000	Rs. 45.00
Profit as in 1980-81	55,000	5.50
Selling Price	5,05,000	50.50

Problem 5-7 (Unit Costing). The cost structure of an article the selling price of which is Rs. 45,000 is as follows :—

Direct Materials	50%
Direct Labour	20%
Overheads	30%

An increase of 15% in the cost of materials and of 25% in the cost of labour is anticipated. These increased costs in relation to the present selling price would cause a 25% decrease in the amount of present profit per article.

You are required :

- (1) To prepare a statement of profit per article at present, and
- (2) The revised selling price to produce the same percentage of profit to sales as before.

(C.A. Inter, November 1987)

Solution. Working Notes :

1. Let 'x' be the total cost and 'y' be the profit for an article whose selling price is Rs. 45,000.

$$\therefore x + y = \text{Rs. } 45,000$$

...(i)

2. Statement showing the present and anticipated cost.

Cost Item	Present Cost		Increase		Anticipated Cost Rs.
	Rs.	%	Rs.		
Direct Material	0.5x	15%	0.075x		0.575x

Direct Labour	0.2x	25%	0.050x	0.250x
Overheads	0.3x		—	0.300x
	<u>x</u>		<u>0.125x</u>	<u>1.125x</u>

3. The increase in the cost of direct material and wages has reduced the present profit by 25%.

$$\therefore 1.125x + 0.75y = \text{Rs. } 45,000$$

—(ii)

4. Solving equations (i) and (ii), we get

$$x = \text{Rs. } 30,000$$

$$y = \text{Rs. } 15,000.$$

(a) Statement showing statement of profit per article

Direct Material	Rs. 0.5x	Rs. 15,000
Direct Labour	0.2x	6,000
Overhead	0.3x	9,000
		<u>30,000</u>
Profit (50% of Cost or $33\frac{1}{3}\%$ of S.P.)		15,000
Selling price		<u>45,000</u>

(b) Statement of Required selling price

Direct Material	Rs. 0.575x	Rs. 17,250
Direct Wages	0.250x	7,500
Overhead	0.300x	9,000
		<u>33,750</u>
Total anticipated profit		16,875
Profit $33\frac{1}{3}\%$ of sales or 50% of cost		<u>50,625</u>
Selling price		<u>50,625</u>

Problem 58. The following data are available from the Cost Ledger of Acme Industries for the year 1987 :-

Plant Maintenance	Rs. 25,000
Lighting	6,300

Depreciation on Plant	8,100
Rates and Taxes for the works	3,900
Staff Salaries	32,000
Management Salaries	22,000
Power (for this Plant)	10,600
Rental for Leasehold Equipments	9,600
Indirect Wages	37,100
Rectification Cost of Defectives (Normal)	8,400
Consumable Stores	17,600
Selling Expenses	30,000
General Charges	15,600
Sale Proceeds from Scrap	4,200

During the year total production was 1,20,000 units. The break-up of prime cost per unit was Materials Rs. 2.20 and Wages Rs. 1.80. The average selling price was Rs. 5 per unit and the entire quantity produced during the year was sold out.

With effect from January 1, 1988, the selling price was reduced to Rs. 4.40 per unit. It was envisaged that production could be enhanced during 1988 by 33½ per cent without incurring any overtime or extra-shift work, or additional selling expenses.

You are required to prepare statements showing :

(i) Actual cost and profit for the year 1987.

(ii) Estimated cost and profit for 1988 assuming that the entire production will be sold during the year.

Assumptions, if any, required to be made in the above exercise should be clearly noted.

(J.C.W.A. Inter, June 1988)

Solution. (i) Acme Industries

Cost Statement for the year 1987

Output : 1,20,000 units

Particulars	Rs.	Amount Rs.	Cost per unit Rs.
Direct Cost			
Materials	2,64,000		2.20
Wages	2,16,000		1.80
Prime Cost		4,80,000	4.00
Variable Expenses—Factory			
Power	10,600		0.088
Rectification Cost—defectives	8,400		0.070
Consumables	17,600		0.147
	36,600		0.305
Less : Sale proceeds from scrap	4,200		0.035
Total Variable Cost		32,400	0.27
Fixed Expenses—Factory			
Plant and Machinery	25,000		0.208
Lighting	6,300		0.053

Depreciation for Plant	8,100	0.068
Rates and Taxes for work	3,900	0.032
Rental for leasehold equipment	9,600	0.080
Indirect Wages	37,100	0.309
Total Fixed Expenses	90,000	0.75
	6,02,400	5.02
<i>actory Cost—Office</i>		
Staff Salaries	32,000	0.267
Management Salaries	22,000	0.183
General Expenses	15,600	0.130
	69,600	0.58
Selling expenses	30,000	0.25
	7,02,000	5.85
Cost of Sales	1,08,000	0.90
Profit	8,10,000	6.75
Sales		

(ii) Estimated Cost Statement for 1988

Estimated output : 1,60,000 units (133½% of 1,20,000 units)

	Amount	Cost per unit
Prime Cost	Rs. 6,40,000	Rs. 4.000
Variable charges less scrap	43,200	0.270
Variable Cost	6,83,200	4.270
<i>Fixed Charges</i>		
Factory	90,000	0.5625
Office	69,600	0.4350
Selling	30,000	0.1875
	1,89,600	1.185
Cost of Sales	8,72,800	5.455
Profit	1,51,200	0.945
Sales	10,24,000	6.400

Assumptions

- Variable expenses have been estimated on unit basis for the year 1988.
- Fixed expenses have taken to be related with time and hence taken to be static.

PRODUCTION ACCOUNT

Problem 5.9. From the following details make up the Cattle Account in the book of Feeders' Ranch Ltd.

	No.	Value Rs.
Cattle (opening value of Live Stock)	100	3,00,000
Cattle Feed (opening stock)	—	30,000

Purchases of Cattle Feed		1,35,000
Purchases of Cattle (during the year)	200	5,85,000
Sales of Cattle (during the year)	150	5,62,500
Sales (Total) of slaughtered Cattle	40	1,80,000
Sales of Carcasses	4	750
Cattle (closing value of Live Stock)	115	5,85,000
Cattle Feed (closing stock)		37,500

Out of calves born during the year 4 died and the carcasses of the calves did not realise anything.

Crop worth Rs. 22,500 grown in the farm was used for feeding. Rs. 15,000 is estimated to be wages for rearing etc. Slaughter house expenses amounted to Rs. 22,500.

Charge depreciation Rs. 7,500 and insurance Rs. 3,750.

(I.C.W.A. Final, June 1986)

Solution.

Cattle Account for the year

	No.	Amount		No.	Amount
To Opening Stock of live stock	100	3,00,000	By Sales of Cattle	150	5,62,500
„ Purchase of Cattle	200	5,85,000	„ Sales of slaughtered Cattle	40	1,80,000
„ Calf born	14*		„ Sales of carcasses	5	750
„ Cost of Cattle feed consumed			„ Calf died	4	—
Op. Stock Rs. 30,000			„ Closing Stock of live stock	115	5,85,000
Purchases		1,35,000			
		1,65,000			
Closing Stock	37,500	1,27,500			
„ Crop grown in farm and used		22,500			
„ Wages for rearing		15,000			
„ Slaughter house exp.		22,500			
„ Depreciation		7,500			
„ Insurance		3,750			
„ Net profit		2,44,500			
	314	13,28,250		314	13,28,250
	==	==		==	==

*Balancing figure of 'No.' column. This is to be derived, as it is not given in the question.

Detailed Production A/c

Problem 5:10. The following details have been obtained from the cost records of Comet Paints Limited :

Stock of raw materials on 1st Sept., 1975

Rs. 75,500

Stock of raw materials on 30th Sept., 1975

91,500

UNIT COSTING, JOB COSTING AND CONTRACT COSTING

P516

Direct wages	52,500
Indirect wages	2,750
Sales	2,11,000
Work-in-progress on 1st Sept., 1975	28,000
Work-in-progress on 30th Sept., 1975	35,000
Purchases of raw materials	66,000
Factory rent, rates and power	15,000
Depreciation of plant and machinery	3,500
Expenses on purchases	1,500
Carriage outwards	2,500
Advertising	3,500
Office rent and taxes	2,500
Travellers' wages and commission	6,500
Stock of finished goods on 1st Sept., 1975	54,000
Stock of finished goods on 30th Sept., 1975	31,000

Prepare a production account giving the maximum possible break-up of costs and profits. (B. Com. Hons., Delhi)

Solution.

Comet Paints Limited**Production Account***For the month ending 30th September, 1975*

	<i>Amount</i>			<i>Amount</i>	
	Rs.	Rs.		Rs.	
To Opening Stock of raw material	75,000		By Prime cost c/d	1,03,500	
Add: Purchases	66,000				
Add: Expenses on purchases	1,500				
Total	1,42,500				
Less: Closing stock of raw material	91,500				
Materials consumed		51,000			
To Direct wages		52,500			
Total		1,03,500			1,03,500
To Prime cost b/d		1,03,500	By Works cost c/d	1,17,750	
To Indirect wages		2,750			
To Factory rent, rates and power		15,000			
To Depreciation of plant and machinery		3,500			
Total		1,24,750			
To Opening W.I.P.		28,000			
		1,52,750			

<i>Less : Closing W.I.P.</i>	35,000		
	<u>1,17,750</u>		<u>1,17,750</u>
To Works cost b/d	1,17,750	By Total cost of	
To Office rent and taxes	2,500	production c/d	1,20,250
Total	<u>1,20,250</u>		<u>1,20,250</u>
To Total cost of production b/d	1,20,250	By Cost of goods sold c/d	1,43,250
To Opening stock of finished goods	54,000		
	<u>1,74,250</u>		
<i>Less : Closing stock of finished goods</i>	31,000		
	<u>1,43,250</u>		<u>1,43,250</u>
To Cost of goods sold b/d	1,43,250	By Cost of sales b/d	1,55,750
To Carriage outward	2,500		
To Advertisement	3,500		
To Travellers' wages and commission	6,500		
	<u>1,55,750</u>		<u>1,55,750</u>
To Cost of sales b/d	1,55,750	By Sales	2,11,000
To Profit	55,250		
	<u>2,11,000</u>		<u>2,11,000</u>

JOB COSTING

Batch cost sheet when overheads are applied on labour hour basis

Problem 5:11. (a) What do you understand by Batch Costing? In which industries is it applied?

(b) Leo Limited undertakes to supply 1,000 units of a component per month for the months of January, February and March 1987. Every month a batch order is opened against which materials and labour cost are booked at actuals. Overheads are levied at a rate per labour hour. The selling price is contracted at Rs. 15 per unit.

From the following data, present the cost and profit per unit of each batch order and the overall position of the order for the 3000 units :

Month	Batch Output (Numbers)	Material Cost	Labour Cost	Overheads	Total Labour Hours
January 1987	1,250	Rs. 6,250	Rs. 2,500	Rs. 12,000	4,000
February 1987	1,500	9,000	3,000	9,000	4,500
March 1987	1,000	5,000	2,000	15,000	5,000

Labour is paid at the rate of Rs. 2 per hour. (C A. Inter, May 1987)

Solution. (a) Please refer to Advanced Cost Accounting (now titled "Cost and Management Accounting—Text") by Saxena and Vashist

(b) Statement showing the Cost and Profit per unit of each batch.

	Jan.	Feb.	March	Total
(i) Batch output (numbers)	1,250	1,500	1,000	3,750
(ii) Total sales realisation from (i) above @ Rs. 15	Rs. 18,750	Rs. 22,500	Rs. 15,000	Rs. 56,250
(iii) Costs				
Material	6,250	9,000	5,000	20,250
Labour	2,500	3,000	2,000	7,500
Overheads (see working note)	3,750	3,000	3,000	9,750
Total Cost	12,500	15,000	10,000	37,500
(iv) Profit (ii) — (iii)	6,250	7,500	5,000	18,750
(v) Profit per unit (iv ÷ i)	Rs. 5	Rs. 5	Rs. 5	
(vi) Cost per unit (iii ÷ i)	10	10	10	

Profitability for 3,000 units

Sales value	(3,000 × Rs. 15)	Rs. 45,000
Less : Costs	(3,000 × Rs. 10)	30,000
Profit		15,000

Working Notes. The batch labour cost for the month is given. The labour is paid @ Rs. 2 per hour. Thus, by dividing the batch labour cost with hourly rate, batch labour hours can be found out :

(a) Batch labour hours	Rs. 2,500 ÷ 2 or 1250 hrs	3,000 ÷ 2 1500 hrs	2,000 ÷ 2 1000 hrs
(b) Overhead per hour	12000 ÷ 4000	9000 ÷ 4500	15000 ÷ 5000
Total overheads ÷ Total labour hours	Rs. 3	Rs. 2	Rs. 3
Overhead for the batch (a × b)	or Rs. 3.750	Rs. 3.000	Rs. 3.000

Computation of Job Cost sheet when maintenance and setup time is given

Problem 5.12. (a) The fixed costs and variable costs per month for a machine are respectively Rs. 18,000 and Rs. 15,000. The number of hours per month are 200 out of which 20 are required for maintenance and another 30 are required for set-up on the average.

(b) The standard labour hours per month in a factory total 60,000. In a particular month the capacity ratio was 120 per cent and the efficiency ratio was 85 per cent. How many hours were actually produced.

A job required 10 hours for set-up besides 30 hours for actual operation. What is the amount which should be charged to the cost of the job in respect of the machine ?
(CS Final, June 1985 Adapted)

Solution.

$$(a) \text{ Fixed Cost per hour} = \frac{\text{Rs. 18,000}}{200 - 20} = \text{Rs. 100 per hour}$$

$$\text{Variable cost per hour} = \frac{\text{Rs. 15,000}}{200 - 20 - 30} = \text{Rs. 100 per hour}$$

Amount to be charged to the job :

Fixed cost 10 + 30 = 40 hrs @ Rs. 100	Rs. 4,000
Variable cost to actual operation 30 hrs × Rs. 100	3,000
	<hr/>
Total charge to job	7,000

$$(b) \text{ Capacity Ratio} = \frac{\text{Hours Worked}}{\text{Budgeted hrs}}$$

$$\text{Hours worked} = 120\% \times 60,000 \text{ hours} = 72,000 \text{ hrs}$$

$$\text{Efficiency Ratio} = \frac{\text{Output in hrs.}}{\text{Hrs. utilized}}$$

$$\text{Output in hours} = 72,000 \times 85\% = 61,200 \text{ hours.}$$

Batch Cost Sheet with defectives

***Problem 5.13.** (a) The following information for the month of April is extracted from the Cost Records of Break and Buy Ltd. which specialise in the manufacture of automobile spares. The parts are manufactured in Department A and assembled in Department B :

	Total	Deptt. A	Deptt. B
Direct Material	Rs. 65,000	Rs. 50,000	Rs. 15,000
Direct Labour	90,000	40,000	50,000
Factory Rent	15,000		
Supervision	6,000	2,500	3,500
Depreciation on Machines	5,000		

Power	4,000		
Repairs of Machines.	2,000	1,600	400
Indirect Labour	4,000	2,000	2,000
Direct Labour Hours worked	80,000	30,000	50,000
Machine Hours worked	30,000	25,000	5,000
Machine Horsepower (H.P.)	400	353	47
Book value of Machines (Rs.)	50,000	40,000	10,000
Floor Space (Sq. ft.)	20,000	10,000	10,000

The Prime cost of Batch B 401 has been booked as under :—

	Total	Deptt. A	Deptt. B
Materials	Rs. 3,200	Rs. 2,700	Rs. 500
Labour	7,500	3,000	4,500

Direct Labour Hours worked on batch B 401 were 2,500 in Department A and 5,000 in Department B. Machine Hours worked in this batch were 1,250 in Deptt. A and 600 in Deptt. B. Allocate Overhead Expenditure and calculate the cost of each unit in batch B 401 which consists of 1,000 units.

(b) The parts are produced to rigorous standards of accuracy. Every batch of 1,000 units is tested to discover whether the units are defective at a cost of Rs. 12·50 per unit. The defective units are then rectified and put in good order at a cost of Rs. 50 per unit. If the units are not tested, any defect would become apparent later when they are fitted in the vehicle. At that stage it would cost Rs. 100 per unit to put the parts in good working order.

Find out by calculation the minimum percentage of defective units in a batch such that it would be cheaper to test all the units in the batch instead of none of them. (C.A. Final, May 1933)

Solution.

Break and Bu7 Ltd.

Allocation of Overhead Expenditure

Machine Cost	Basis	Total	Deptt. A	Deptt. B
Depreciation	Plant value 4:1	5,000	4,000	1,000
Power	Horse Power 353:47	4,000	3,530	470
Repair to Mach.	Actual	2,000	500	400
Total Machine Cost		11,000	9,130	1,870

Machine Cost for Jobs

	A	B
Available Machine Hours	25,000	5,000
Machine hour rate	Rs. 0·3652	Rs. 0·374
Machine hours spent for job	1,250 hrs.	600 hrs.
Machine Cost	Rs. 456·50	Rs. 224·40

Joint Overheads

Factory rent	Space 1 : 1	15,000	7,500	7,500
Supervision	Actual	6,000	2,500	3,500
Indirect labour	Actual	4,000	2,000	2,000
Total overhead		25,000	12,000	13,000

(For Other O.H. for jobs)

Available labour hours	30,000	50,000
Labour hour rate	Re. 0.40	Re. 0.26
Labour hours for Jobs	2500	5,000
Labour Cost for jobs 401	Rs. 10,000	Rs. 1,300

Based on machine hours and direct labour hours, Machine Cost and other overhead costs can be distributed.

Cost of job 401 (Consisting of 1000 units)

	Total	Deptt. A	Deptt. B
Material	Rs. 3,200.00	2,700	500
Labour	7,500.00	3,000	4,500
Factory Cost :			
Machine Cost	680.90	456.50	224.40
Other O.H. Costs	2300.00	1,000.00	1,300.00
Total Cost	13,680.90	7,156.50	6,524.40

Cost per unit = Rs. 13,680.90 ÷ 1000 units = Rs. 13.68

(b) (i) Total Cost of testing 1000 × Rs. 12.50 = Rs. 12,500

(ii) Suppose units defective are x. Total Cost of rectification = (Rs. 100 - Rs. 50)x

∴ Cost indifference point is the level at which total costs between the two alternatives are equal.

∴ Rs. 50 x = Rs. 12,500

x = Rs. 250 units

∴ Company must test if defectives are above 25%, because at this level total costs of two alternatives are the same.

Computation of manufacturing cost of pipe and value of closing inventory

Problem 5:14. The pipe company has been in operation for one year. It manufactures concrete pipes in lengths of 4 metres and has the necessary equipment to produce 18—, 24—, 30— and 36 mm. pipe. The company has one basic machine to produce pipe. Only one size is made during each working day of eight hours, the last hour of which is used by the crew for clean-up and, as necessary, for changing the machine so that a different size can be made the following day. Production during the first year was limited to sizes from 18 to 30 mm. inclusive. The company has prepared the following schedule of profit and loss for the year just ended :

Sales	Rs.	Rs. 58,000
Raw material purchases	17,657	
Direct Labour	13,255	
Freight inward	2,447	
Delivery expenses	3,582	
Depreciation .		
Factory building	600	
Office building	280	
Factory machinery	3,000	
Office furniture	200	
Electric power—factory	1,519	
Shop supplies	2,550	
Office salaries	1,000	
Office salaries and expense	5,200	
Telephone and telegraph	375	
Repairs and maintenance		
—factory	2,175	
Commission on sales	2,700	
Other factory expenses	760	
General Office expenses	200	
Raw material Inventory—		
year end		1,630
Finished Good Inventory—year-		
end (as estimated)		5,990
Profit for year	8,120	
	<u>65,620</u>	<u>65,620</u>

Your review of records discloses the following data as to production and sales :

Pipe Dia-meter	Metres Produced	Metres Sold	Metres unsold	Kgs. per metre	Total weight kgs.	Production per day metres	Selling price per metre
18	7,200	6,200	1,000	150	1,50,000	120	Rs. 2.20
24	10,200	8,120	2,080	250	5,20,000	100	3.00
30	6,320	5,000	1,320	400	5,28,000	80	4.00

You are required to :

- Compute the manufacturing cost of each size of pipe during the year on a per metre basis.
 - Prepare a schedule showing which size of pipe would be most profitable.
 - Compute the value for the closing inventory of pipe of each size.
- (I.C.W.A. Inter, June 1985)

Solution.

Statement showing total weight produced

Pipe Dia	Metres Produced	Weight in kg. per metre	Total weight in kg
18 mm	7,200	150	10,80,000

24 mm	10,200	250	25,50,000
30 mm	6,320	400	25,28,000
			<u>61,58,000</u>

Raw material consumed Rs. 17,657 + Rs. 2,447 = Rs. 1,630
= Rs. 18,474

Raw material cost per kg = Rs. 18,474 ÷ 61,58,000 = Re. 0.003

Raw Material Cost per metre :

18 mm = 150 kg × Re 0.003 = Re. 0.45

24 mm = 250 kg × Re 0.003 = 0.75

30 mm = 400 kg × Re 0.003 = 1.20

Conversion cost required to manufacture :

= Labour + Factory Overhead

= 13,255 + (1,519 + 7,550 ÷ 2.175 + 760 ÷ 3,000 + 600)

= Rs. 23,859

For Total Number of days worked :

(Mtrs Produced ÷ Production per day in Metre)

18 mm = 7200 Metres ÷ 120 Metres = 60 days

24 mm = 10200 Metres ÷ 100 Metres = 102 days

24 mm = 6320 Metres ÷ 80 Metres = 79 days

241 days

Conversion cost per day = Rs. 23,859 ÷ 241 = Rs. 99.

Conversion cost per metre : (99 ÷ Production in metres per day)

18 mm = Rs. 99 ÷ 120 = Re. 0.825

24 mm = Rs. 99 ÷ 100 = Re. 0.99

30 mm = Rs. 99 ÷ 80 = Rs. 1.2375.

(a) Manufacturing cost of each size per metre

Pipe Dia Raw Material Cost + Conversion Cost

18 mm Re. 0.45 + Re. 0.825 = Rs. 1.275

24 mm Re. 0.75 + Re. 0.99 = 1.74

30 mm Rs. 1.20 + Rs. 1.2375 = 2.44

(b) Statement showing profitability of different sizes

Pipe Dia Selling Price - Manufacturing Cost = Gross Profit

18 mm Rs. 2.20 - Rs. 1.275 = Re. 0.925

24 mm 3.00 - 1.74 = 1.26

30 mm 4.00 - 2.44 = 1.56

30 mm pipe dia is most profitable.

(c) Value of closing inventory

18 mm - 1000 metre × Rs. 1.275 = Rs. 1275.00

24 mm - 2080 metre × Rs. 1.74 = 3619.20

30 mm - 1320 metre × Rs. 2.44 = 3220.80

Total

8115.00

Note : Items of office expense will not form part of manufacturing cost.

***Problem 5'15.** Spun Tube Co. can produce tubes of 4 different diameters. D_1 , D_2 , D_3 and D_4 all of the same length on the same equipment producing only one size every day. The following information is available in respect of the year just completed.

Tube dia	Produced Metres	Sold Metres	Year-end stock			Average Production per day (Metres)	Selling Price per Metre Rs.
			Metres	Weight in kgs. per 100 metres	Total weight in kgs.		
D_1	1,12,000	1,05,000	7,000	40	2,800	1,400	9'00
D_2	1,47,000	1,40,875	6,125	50	3,063	1,225	11'00
D_3	1,05,000	99,750	5,250	65	3,413	1,050	15'00

(i) There were no opening stock of inventories.

(ii) The size D_4 was not produced at all.

(iii) Technical specification of D_4 are :

875 metres can be produced on an average per day. Weight per 100 metres of this tube will be 80 kgs. and this can be sold at Rs. 18 per metre.

A suitable grouping of the Profit and Loss account for the year is also reproduced below :

Sales		Rs. 41.37.000
Raw Material	Rs. 14,36.000	
Direct Labour	7,50,000	
Variable Overhead	3,50,000	
Fixed Overhead	8,50,000	
Inventory :		
Raw Material		1,31,000
Finished Goods		1,63,000
Profit	10 45,000	
	44,31,000	44,31,000
	=====	=====

You are required to calculate :

- the total cost of each size of tube per metre basis.
- the value of finished goods stock at the end of the year at cost as under (i).
- the profitability of each size of tube, and
- to prepare the cost estimate for the size D_4 per metre length compute the profit in its selling.

Note : The Direct material cost per kg. on the finished tube is found and to be the same for all sizes. The expenses were uniform throughout the year. (I.C.W.A. Final, December 1984)

Solution. Cost per Metre for different sizes

Total weight produced :

Tube dia	Metres Produced	Weight in kg per 100 Metres	Working	Total weight in kg.
D ₁	1,12,000	40	(1,12,000 × 0.40) =	44,800
D ₂	1,47,000	50	(1,47,000 × 0.50) =	73,500
D ₃	1,05,000	65	(1,05,000 × 0.65) =	68,250
				<u>1,86,550</u>

Raw Material consumed = Rs. 14,36,000 - Rs. 1,31,000 = Rs. 13,05,000

Raw Material Cost per kg. = Rs. 6.9954

Raw material cost per metre for different sizes

D₁ (40 kg ÷ 100 Metre) × Rs. 6.9954 = Rs. 2.80

D₂ (50 kg ÷ 100 Metre) × Rs. 6.9954 = Rs. 3.50

D₃ (65 kg ÷ 100 Metre) × Rs. 6.9954 = Rs. 4.55

Conversion cost per day for different size :

Total Conversion Cost = Rs. 7,50,000 + Rs. 3,50,000 = Rs. 8,50,000

= Rs. 19,50,000

For Total Number of days worked : Total production ÷ Production in one day

D₁ was produced for—(1,12,000 Metres ÷ 1400 Metres) = 80 days

D₂ was produced for—(1,47,000 Metres ÷ 1225 Metres) = 120 days

D₃ was produced for—(1,05,000 Metres ÷ 1050 Metres) = 100 days

∴ Production was carried on for 300 days

∴ Conversion cost per day = Rs. 19,50,000 ÷ 300 days = Rs. 6,500

Conversion cost per Metre for different sizes :

D₁—(80 days × Rs. 6,500) ÷ 1,12,000 Metres = Rs. 4.64 per Metre

D₂—(120 days × Rs. 6,500) ÷ 1,47,000 Metres = Rs. 5.31 per Metre

D₃—(100 days × Rs. 6,500) ÷ 1,05,000 Metres = Rs. 6.19 per Metre

(i) The total cost of each size per metre basis

Tube Dia	Material cost per metre	+ Conversion cost per metre	= Total cost per metre
D ₁	Rs. 2.80	+ Rs. 4.64	= Rs. 7.44
D ₂	Rs. 3.50	+ Rs. 5.31	= Rs. 8.81
D ₃	Rs. 4.55	+ Rs. 6.19	= Rs. 10.74

(ii) Value of finished goods stock at the end of the year at cost as under (i)

D₁—7,000 Metres × Rs. 7.44 = Rs. 52,080

D_2 —6,125 Metres \times Rs. 8.81 = Rs. 53,961

D_3 —5,250 Metres \times Rs. 10.74 = Rs. 56,385

1,62,426

(iii) Profitability of each size

Tube Dia	Selling Price per Metre	—	Total cost per Metre	= Profit per Metre
D_1	Rs. 9.00	—	Rs. 7.40	= Rs. 1.60
D_2	Rs. 11.00	—	Rs. 8.81	= 2.19
D_3	Rs. 15.00	—	Rs. 10.74	= 4.26

(iv) Cost estimate and Profit for size D_4

Material cost = (80 kg \times Rs. 6.9954) \div 100 metre = Rs. 5.60

Conversion cost = Rs. 6,500 \div 875 Metres = 7.43

Total Cost 13.03

Profit 4.97

Selling Price 18.00

Computation of Revised Factory cost by applying different overhead recovery rates.

Problem 5.16. XYZ manufactures household pumps which pass through three departments, viz., Foundry, Machine Shop and Assembling. The manufacturing expenses are as follow :

	Foundry	Machine Shop	Assembling	Total
Direct wages	Rs. 10,000	Rs. 50,000	Rs. 10,000	Rs. 70,000
Works overhead	5,000	90,000	10,000	1,05,000

The factory cost of manufacturing a type 'C' pump was prepared by the company as follows :

Material Rs. 16

Direct wages :

Foundry	2	
Machine shop	4	
Assembling	2	8

Works overhead (150% of Direct wages) 12

Total cost 36

It seems that there is some fallacy. Try to correct it.

(I.C.W.A. Inter, June 1983)

Solution. A single overhead of 150% of direct wages has been adopted for all the three departments. This procedure is incorrect and faulty. Direct wages for all the three departments are given and as such it is possible to work out separate overhead rates for each department. Correct overhead recovery rates for each department will be as follows :

Overhead for each dept. _____
Direct wages for each deptt. _____ $\times 100$

- (i) Foundry $= (5,000 \div 10,000) \times 100 = 50\%$
 (ii) Machine shop $= (90,000 \div 50,000) \times 100 = 180\%$
 (iii) Assembling $= (10,000 \div 10,000) \times 100 = 100\%$

So, the correct factory cost of manufacturing a type 'C' pump will be as follows :

Material			Rs. 16'00
Direct wages .			
Foundry	Rs. 2		
Machine shop	4		
Assembling	2		8'00

Factory overhead :			
Foundry $(2 \times 50) \div 100$	1'00		
Machine shop $(4 \times 180) \div 100$	7'20		
Assembling $(2 \times 100) \div 100$	2'00		10'20
	-----		-----
Revised Factory Cost			34'20

There is a difference of Rs. 1'80 in the factory cost now worked out and the factory cost as given in the question. The factory cost given in the problem is more by Rs. 1'80 due to over-recovery of overhead.

Manufacturing cost of bricks

Problem 5-17. A company is manufacturing building bricks and fire bricks. Both the products require two processes : Brick-forming and Heat-treating.

Time requirements for the two bricks are :

	<i>Building Bricks</i>	<i>Fire Bricks</i>
Forming		
per 100 Brick	3 Hrs	2 Hrs
Heat-treatment		
per 100 Bricks	2 Hrs	5 Hrs

Total costs of the two departments in one month were :—

Forming	Rs. 21,200
Heat-treatment	Rs. 48,800

Production during the month was :

Building Bricks	1,30,000 Nos.
Fire Bricks	70,000 Nos.

Prepare a statement of manufacturing cost for the two varieties of bricks.
 (C.A. Inter, November 1983)

Solution

Working Notes

1. Brick Forming

- (a) Time required for Building bricks —

$$(130,000 \times 3) \div 100 \quad 3,900 \text{ Hrs.}$$

(b) Time required for fire bricks $(70,000 \times 2) \div 100$ 1,400 Hrs.

Total hours spent for brick forming 5,300 Hrs.

Total Cost of Brick Forming Rs. 21,200

Cost per hour of brick forming 4

2. Heat Treatment

(a) Time required for Building Bricks $(1,30,000 \times 2) \div 100$ 2,600 Hrs.

(b) Time required for Fire Bricks $(70,000 \times 5) \div 100$ 3,500 Hrs.

6,100 Hrs.

Total Cost of Heat Treatment Rs. 48,800

Cost per hour of Heat Treatment department Rs. 8

Statement showing manufacturing Cost of Building Bricks

Process	Time for 100 No. (Hrs.)	Rate per hour	Cost per 100 No.	Cost for 1,30,000 Nos.
Brick forming	3	4	Rs. 12	Rs. 15,600
Heat treatment	2	8	16	20,800
			28	36,400

Statement showing manufacturing Cost of Fire Bricks.

Process	Time for 100 No. (Hrs.)	Rate per hour	Cost per 100 No.	Cost for 70,000 No.
Brick-forming	2	4	Rs. 8	Rs. 5,600
Heat-treatment	5	8	40	28,000
			48	33,600

Computation of invoice price of jobs on cost-plus basis (with adjustment entries)

Problem 5-18. In a factory following the Job Costing Method, an abstract from the work in process as at 30th September was prepared as under :

<i>Job No.</i>	<i>Materials</i>	<i>Direct Labour</i>	<i>Factory Overheads Applied</i>
115	Rs. 1,325	400 hours Rs. 800	Rs. 640
118	810	250 hours 500	400
120	765	300 hours 475	380
	<u>2,900</u>	<u>1,775</u>	<u>1,420</u>

Materials used in October were as follows :

<i>Material Requisition No.</i>	<i>Job No.</i>	<i>Cost Rs.</i>
54	118	300
55	118	425
56	118	515
57	120	665
58	121	910
59	124	720
		<u>3,535</u>

A summary of Labour Hours deployed during October is as under :

<i>Job No.</i>	<i>Number of Hours</i>	
	<i>Shop A</i>	<i>Shop B</i>
115	25	25
118	90	30
120	75	10
121	65	—
124	20	10
	<u>275</u>	<u>75</u>
Indirect Labour :		
Waiting for Material	20	10
Machine Breakdown	10	5
Idle Time	5	6
Overtime Premium	6	5
	<u>316</u>	<u>101</u>

A shop credit slip was issued in October, that material under requisition No. 54 was returned back to stores as being not suitable. A material Transfer Note issued in October indicated that material issued under requisition No. 55 for Job 118 was directed to Job 124.

The hourly rate in Shop *A* per labour hour is Rs. 3 per hour while at Shop *B* it is Rs. 2 per hour. The factory overhead is applied at the same rate as in September. Jobs 115, 118 and 120 were completed in October.

You are asked to compute the factory cost of the completed jobs. It is the practice of the management to put a 10% on the factory cost to cover administration and selling overheads and invoice the job to the customer on a total cost-plus 20% basis. What would be the invoice price of these three jobs. (C.A. Inter, November 1985)

Solution.

Statement showing Factory Cost of Completed Jobs

Elements	Month	Jobs		
		115	118	120
Material	Sept.	Rs. 1 325	Rs. 850	765
	Oct.		515	665
Labour	Sept.	800	500	475
(Refer to working note 1)	Oct.	125	330	245
Overhead	Sept.	640	400	380
80% of of D. labour in Oct.	Oct.	100	264	196
		2,990	2,819	2,726

Working Note : Job 115—Shop *A* : 25 Hrs \times Rs. 3 = Rs. 75.00
Shop *B* : 25 Hrs \times Rs. 2 = Rs. 50.00

125.00

Job 118—Shop *A* : 90 Hrs \times Rs. 3 = Rs. 270
Shop *B* : 30 Hrs \times Rs. 2 = Rs. 60

330

Job 120—Shop *A* : 75 Hrs \times Rs. 3 = 225
Shop *B* : 10 Hrs \times Rs. 2 = 20

245

Invoice Price of Completed jobs

Job No.	115	118	120
Factory Cost	Rs. 2,990	Rs. 2,819.00	Rs. 2,726.00
Adm. and selling overhead			

UNIT COSTING, JOB COSTING AND CONTRACT COSTING

P531

10% of factory Cost	299	281.90	272.60
Total Cost	3,289.00	3,100.90	2,998.60
Profit (20% of Cost)	657.80	620.18	599.72
Invoice Price	3,946.80	3,721.08	3,598.32

Computation of Prime Cost of Job

Problem 5.19. You are presented with the following information by Sphinx Engineering Co. relating to the first week of September, 1985.

(A) **Materials**—The transactions in connection with the materials are as follows :

Days	Receipts		Issues
	Units	Rate per unit (Rs.)	Units
1st	40	15.00	
2nd	20	16.50	
3rd			30
4th	50	14.30	
5th			20
6th			40

Calculate cost of material issued under FIFO method and Weighted Average method of issue of materials.

(B) **Labour**—The firm employs 5 workers at an hourly rate of Rs. 2.00. During the week they worked for 4 days for a total period of 40 hours each and completed a job for which the standard time was 48 hours for each worker.

Calculate the labour cost under the Halsey method and Rowan method of incentive plan payments.

(C) Compute the prime cost of the job completed under the different methods of valuing material issues and calculation of labour costs.

(I.C.W.A. Inter, Dec. 1985)

Solution :
(A) **Sphinx Engineering Co.**
Statement showing Receipts and Issues adopting FIFO Method

Date Sept.	Receipts		Issues		Balance	
	Unit	Rs.	Unit	Rs.	Unit	Rs.
1st	40	15'00			40	15
2nd	20	16'50			40	15
					20	16'50
3rd			30	15	10	15
				Rs. 450	20	16'50
4th	50	14'30			10	15
				715	20	16'50
5th			10	15	50	14'30
			10	16'50	10	16'50
6th			10	16'50	50	14'30
			30	14'30	20	14'30
				429		
				1,359		

Statement showing Receipts and Issues adopting weighted average method

Date	Receipts		Issues		Balance	
	Unit	Rs.	Unit	Rs.	Unit	Rs.
1st	40	15'00			40	15'00
2nd	20	16'50			60	15'50
3rd			30	15'50	30	15'50
4th	50	14'30			80	14'75
5th			20	14'75	60	14'75
6th			40	14'75	20	14'75
				590		
				1,350		

(B) Data given

- (i) Standard time for the job — $5 \times 48 \text{ hrs} = \text{Rs. } 240$
 (ii) Wage Rate — Rs. 2 per unit
 (iii) Time taken to do the job — $40 \text{ hrs} \times 5 = 200 \text{ hrs.}$

Wages earned under

(a) Rowan system of Incentive PaymentBasic wages for time allowed $5 \times 40 \times 2 =$ Rs. 400*Incentive Bonus*

$$\frac{\text{Time Saved}}{\text{Time Allowed}} \times \text{Time taken} \times \text{hourly rate}$$

$$= \frac{5 \times 8 \text{ hrs}}{5 \times 48 \text{ hrs}} \times 200 \text{ hrs} \times 2$$

67

$$= \text{Total earnings} \quad 467$$

(b) Halsey system of Incentive PaymentBasic wages for time worked $5 \times 40 \times 2 = \text{Rs. } 400$ *Incentive Bonus*

$$\frac{1}{2} (\text{Time Saved}) \times \text{hourly rate}$$

$$\frac{1}{2} (5 \times 8) \times 2$$

40

$$\text{Total wages} \quad 440$$

(c) Prime cost under different methods

	FIFO/Halsey	FIFO/Rowan	Wt. Average, Halsey	Wt. Average, Rowan
Material	1,359	1,359	1,350	1,350
Labour	440	467	440	467
Prime cost	1,799	1,826	1,790	1,817

CONTRACT COSTING**Computation of profit when 50% work is complete**

Problem 5-20. Utility Builders obtained a contract to construct a building for Rs. 3 crores. Building work commenced on 1st October, 1985 and at the close of financial year as on 31st March, 1986 the construction was still in progress. The following information is available :

- (a) Party paid Rs. 1.20 crores being 80% of the amount as per Surveyor's Certificate of work completed as on 31st March, 1986.
 (b) Total cost as per contract account after adjustment of closing work-in-progress was Rs. 1.35 crores.

As a prudent Accountant determine the amount of profit Utility Builders are justified in taking to the credit of their profit and loss account.
 (C.S. Final, June 1986)

Solution :

Work certified = $(1.20 \text{ crores} \times 100) \div 80 = 1.50 \text{ crores}$

Cost of contract up to 31-3-86 = 1.35 „

Notional profit 0.15 crores

Calculation of profit to be taken to P & L A/c.

$= \frac{2}{3} \times \text{Notional profit} \times \frac{\text{cash received}}{\text{work certified}}$

$= \left(\frac{2}{3} \times 0.15 \text{ crores} \times \frac{1.20 \text{ crores}}{1.50 \text{ crores}} \right)$

= Rs. 0.08 crores, i.e., 8 lakhs.

Preparation of Memorandum Contract A/C, after considering Reserve for contingencies

***Problem 5.21.** M/s Tom & Dick obtained a contract to build quarters, the price being Rs. 1,00,000. Work was started on 1st April, 1967 and the following expenditure was incurred :

Plant	Rs. 5,000
Stores	18,000
Wages	16,250
Sundry expenses	1,325
Establishment charges	2,925

A part of the material was unsuitable and was sold for Rs. 3,625 (cost being Rs. 3,000). A portion of the plant was scrapped and disposed for Rs. 575.

The value of plant on 31st March 1968 was Rs. 1,550 and of stores Rs. 850. Cash received on account was Rs. 35,000, representing 80% of the work certified. The work uncertified was valued at Rs. 5,475 and this was certified later for Rs. 6,250.

M/s. Tom and Dick decided to estimate what further expenditure would be incurred in completing the contract, to compute from this estimate and the expenditure already incurred, the total profit that would be made on this contract and to take to credit P & L account for the year 1967-68, that provision of the total which corresponded to the work certified on 31-3-68.

Their estimate reveals that contract would be completed after 9 months, till then wages likely to be incurred Rs. 17,875. The cost of stores, etc., required in addition to those in stock on 31-3-68, would be Rs. 17,150, and that further contract expenses would amount to Rs. 1,500. A further investment of Rs. 6,250 would be required on plant which would be valued on 31-12-68 at Rs. 750. The establishment charges would be same on monthly basis, as in the preceding year. Lastly 2½% of the total cost of contract should be kept as reserve for contingencies.

Prepare contract, stores and plant accounts for the year ended 31st March 1968, and also show your calculation of the amount credited to Profit and Loss A/c for the year. (C.A. Final, England—Adapted)

Solution. Contract Account**Dr.** *for the period ending 31st March 1968* **Cr.**

To Material from store	Rs. 14,150*	By Work-in-progress	Rs.
To Plant	2,875@	Work certified	43,750
To Wages	16,250	Work uncertified	5,475
To Sundry expenses	1,325		
To Estab. charges	2,925		
To Balance c/d	11,700		
	<u>49,225</u>		<u>49,225</u>
To P & L A/c	5993.20*	By Balance b/d	11,700.00
To Reserve A/c	5706.80		
	<u>11,700.00</u>		<u>11,700.00</u>

Stores Account

To Bank A/c	Rs. 18,000	By Bank (material sold)	Rs. 3,625
To P & L A/c	625	By Balance c/d	850
		By Contract A/c	14,150*
	<u>18,625</u>		<u>18,625</u>

Plant Account

To Bank A/c	Rs. 5,000	By Bank (scrapped plant sold)	Rs. 575
		By Balance c d	1,550
		By Contract A/c	2,875@
	<u>5,000</u>		<u>5,000</u>

Memorandum Contract A/c
(31-12-68)

	Rs.	Rs.		Rs.
To Materials :			By Contract A/c	1,00,000.00
As per Contract A/c	14,150			
Add : Closing balance (March 68)	850			
Add : Additional stores required	17,150	32,150.00		
To Plant :				
As per Contract A/c	2,875			
Add : Closing balance (Mach 68)	1,550			
Add : Additional plant investment	Rs. 6,250	Rs.		

10,675

Less : Closing stock as on 31-12-68	750	9,925.00	
To Wages :			
As per Contract A/c	16,250		
Add : Additional wages	17,875	34,125.00	
To Sundry exp. as per Contract A/c	1,325		
Additional	1,500	2,825.00	
To Estab. charges	2,925.00		
Additional for 9 months	2,193.75	5,118.75	
To Reserve 2.5% on total cost		2,157.50@	
Total cost	86,301.25		
Total net profit	13,698.75		
	1,00,000.00		1,00,000.00

@ Total cost of (without reserve) = 84,143.75

Reserve @ 2.5% on total cost = $\frac{84,143.75 \times 2.5}{100} = \text{Rs. } 2,157.50$

* Calculation of P & L A/c and Reserve A/c

= Net Profit as per M. no. contract A/c $\times \frac{\text{Work certified}}{\text{Contract price}}$

= $13,698.75 \times \frac{43,750}{1,00,000} = \text{Rs. } 5,993.20$

Reserve = Rs. 11,700 - 5,993.20 = Rs. 5,706.80

Problem 5-22 (Contract Costing). Modern Constructions Ltd. has taken two contracts on 1st October, 1985. The position of contracts on 30th September 1986 is as follows :

	Contract I	Contract II
Contract price	27,00,000	60,00,000
Materials	5,80,000	10,80,000
Wages paid	11,24,000	16,50,000
Other expenses	28,000	60,000
Plant at site	1,60,000	3,00,000
Unused materials at site	40,000	60,000
Wages payable	36,000	54,000
Other expenses due	4,000	9,000
Work certified	16,00,000	30,00,000
Cash received	12,00,000	22,50,000
Work completed but not yet certified	80,000	90,000

UNIT COSTING, JOB COSTING AND CONTRACT COSTING

The plant at site is to be depreciated at 10%. Prepare the contract accounts in respect of each work showing the notional profit and also profit to be transferred to Profit and Loss Account.

(C.S. Inter, December 1987)

Solution.	Contract A/c No. 1	Rs
To Material Rs. 5,80,000	By Work certified	16,00,000
Less : Unused material 40,000	„ Work not yet completed	80,000
5,40,000	„ Loss transferred to P & L A/c	68,000
„ Wages 11,24,000		
Add : Wages payable 36,000		
11,60,000		
„ Other Exp. 28,000		
Add : Exp. due 4,000		
32,000		
„ Depreciation 10% of Rs. 1,60,000	16,000	
	17,48,000	17,48,000

Note : Provision for this loss may be made in P & L A/c as an abundant caution

	Contract A/c No. 2	Rs.
To Material Rs. 10,80,000	By Work certified	30,00,000
Less : Unused material 60,000	„ Work not yet completed	90,000
	10,20,000	
To Wages 16,50,000		
Add : Wages payable 54,000		
	17,04,000	
„ Other Exp. 60,000		
„ Exp. due 9,000		
	69,000	
„ Depreciation 30,000		
„ Notional Profit 2,67,000		
	30,90,000	30,90,000
„ P & L A/c 1,33,500*	By Notional Profit	2,67,000
„ W.I.P. 1,33,500		
	2,67,000	2,67,000

$$* \frac{2}{3} \times \frac{\text{Cash Received}}{\text{Work certified}} \times \text{Notional Profit}$$

$$= \frac{2}{3} \times \frac{22,50,000}{30,00,000} \times 2,67,000 = \text{Rs. } 1,33,500.$$

Contractwise P & L A/c and WIP A/c of three Contracts

Problem 523. The following particulars are obtained from the books of Vinak Construction Ltd. as on March 1983 :—

Plant and Equipment at cost	Rs. 4,90,000
Vehicles at cost	Rs. 2,00,000

Details of contract which remain uncompleted as on 31-3-1983 :

	Contract Nos.		
	V. 20	V. 24	V. 25
	(Rs. Lacs)	(Rs. Lacs)	(Rs. Lacs)
Estimated final sales value	8.00	5.60	16.00
Estimated final cost	6.40	7.00	12.00
Wages	2.40	2.00	1.20
Materials	1.00	1.10	0.44
Overheads (excluding Depreciation)	1.44	1.46	0.58
Total costs to date	4.84	4.56	2.22
Value certified by architects	7.20	4.20	2.40
Progress payments received	5.00	3.20	2.00

Depreciation of Plant and Equipment and Vehicle should be charged at 20% to the three contracts in proportion to work certified.

You are required to prepare statements to show contract-wise and total :

(i) Profit/Loss to be taken to the P & L A/c for the year ended 31st March 1983 ;

(ii) Work-in-progress as would appear in the Balance Sheet as at 31st March 1983. (C.A. Inter, May 1983)

Solution :

(A) (i) 1. *Percentage of completion.* $\frac{\text{Work certified}}{\text{Contract Price}} \times 100$

Contract No.

V. 20 = $(7.20 \text{ Lakhs} \div 8.00 \text{ Lakhs}) \times 100 = 90\%$

V. 24 = $(4.20 \text{ Lakhs} \div 5.60 \text{ Lakhs}) \times 100 = 75\%$

V. 25 = $(2.40 \text{ Lakhs} \div 16.00 \text{ Lakhs}) \times 100 = 15\%$

2. *Estimated Result on completion.*

	V. 20	V. 24	V. 25
	(Rs. in lakh)	(Rs. in lakh)	(Rs. in lakh)
Estimated Sale value	8.00	5.60	16.00
Total Cost to date	6.40	7.00	12.00
Estimated P&L A/c	1.60	(1.40)	4.00

3. Results to date

(Rs. in lakhs)
Total

Work certified	7.20	4.20	2.40	13.80
Cost to date	4.84	4.56	2.22	11.62
Depreciation	0.72	0.42	0.24	1.38
Total Cost	5.56	4.98	2.46	13.00
Notional Profit (loss)	1.64	(0.78)	(0.06)	0.80
Profit (loss) to be taken to P & L A/c	1.00	(1.40)*	(0.06)	(0.46)
Reserve for Contingencies	0.64	(0.62)	—	1.26

* It is prudent accounting practice to provide for full known losses.

(A) (ii) Statement showing work-in-progress as it would appear in Balance Sheet as at 31st March 1983

	V. 20	Contract No. V. 24	(Rs. lakh) V. 25	Total
Work certified	7.20	4.20	2.40	13.80
Less : Payment received	5.00	3.20	2.00	10.20
Less : Reserve for contingencies	0.64	0.62	—	1.26
Work in progress to be shown in Balance Sheet	1.56	0.38	0.40	2.34

Working Notes

1. **Depreciation.** Capital loss of Plant, Equipment and Vehicle
=Rs. 4,90,000 ÷ Rs. 2,00,000 = Rs. 6,90,000

Depreciation (Total) 20% = Rs. 1,38,000

This has been distributed to contracts in the ratio of work certified

Depreciation.

V. 20 = (7.20 lakh ÷ 13.80 lakh) × Rs. 1.38 lakh = 0.72 lakh

V. 24 = (4.20 lakh ÷ 13.80 lakh) × Rs. 1.38 lakh = 0.42 lakh

V. 25 = (2.40 lakh ÷ 13.80 lakh) × Rs. 1.38 lakh = 0.24 lakh

2. **Profit taken to P & L A/c** = Following formula has been used as contract is in advance stage of completion

= Estimated Profit × Cash Received / Work certified

= 1.60 lakh × 5.00 lakh / 7.20 lakh

= 1.11 lakh.

Computation of profit of contract (80% complete) and different methods of profit computation

Problem 524. Compute a conservative estimate of profit on a contract (which has been 80% complete) from the following particulars. Illustrate at least 4 methods of computing the profit :

Total expenditure to date	Rs. 85,000
Estimated further expenditure to complete the contract (including contingencies)	17,000
Contract Price	1,53,000
Works certified	1,00,000
Works not certified	8,500
Cash received	81,600

(I.C.W.A Inter, December 1984)

Solution.

Value of work certified	Rs. 1,00,000
Work not certified	8,500
Total work done so far	1,08,500
Less : Total exp. up to date	85,000
Notional Profit	23,500
Contract Price	Rs. 1,53,000
Less : Exp. up to date	Rs. 85,000
Estimated further exp. to complete contract	17,000
Estimated total profit	51,000

Four methods of Computing Profit :

- $$\frac{2}{3} \times \text{Notional Profit} \times \left(\frac{\text{Cash received}}{\text{work certified}} \right)$$

$$= \frac{2}{3} \times \text{Rs. } 23,500 \times \left(\frac{\text{Rs. } 81,600}{\text{Rs. } 1,00,000} \right) = \text{Rs. } 12,784$$
- $$\text{Notional Profit} \times \left(\frac{\text{Work certified}}{\text{Contract price}} \right)$$

$$= 23,500 \times \left(\frac{\text{Rs. } 1,00,000}{\text{Rs. } 1,53,000} \right) = \text{Rs. } 15,359$$
- $$\text{Estimated Total Profit} \times \frac{\text{Value of work certified}}{\text{Contract price}}$$

$$= \frac{\text{Cost received}}{\text{Value work certified}} \times \text{Estimated total profit}$$

$$= \text{Rs. } 51,000 \times \left(\frac{\text{Rs. } 81,600}{\text{Rs. } 1,00,000} \right) = \text{Rs. } 41,616$$
- $$\text{Estimated total profits} \times \frac{\text{Cost of work to date}}{\text{Estimated total cost}}$$

$$= \frac{\text{Cash received}}{\text{Value of work certified}} \times \text{Estimated total profits}$$

$$= \text{Rs. } 51,000 \times \left(\frac{\text{Rs. } 81,600}{\text{Rs. } 1,02,000} \right) = \text{Rs. } 40,680$$

ESCALATION CLAUSE**Escalation claim and final price of contract**

Problem 5.25. A contractor has entered into a long-term contract at an agreed price of Rs. 1,75,000 subject to an escalation clause for materials and wages as spelt out in the contract and corresponding actuals are as follows :

Materials :	Standard	Actuals
A	5000 Kgs. @ Rs. 5/-	5050 Kgs. @ Rs. 4.80
B	3500 Kgs. @ 8/-	3450 Kgs. @ 7.90
C	2500 Ltrs. @ 6/-	2600 Ltrs. @ 6.60
Wages :		
P	2000 Hrs. @ Rs. 7/-	2100 Hrs. @ Rs. 7.20
Q	2500 Hrs. @ 7.50	2450 Hrs. @ 7.50
R	3000 Hrs. @ 6.50	3100 Hrs. @ 6.60

Reckoning the full actual consumption of materials and wages the company has claimed a final price of Rs. 1,77,360. Give your analysis of the admissible escalation claim and indicate the final price payable.

(I.C.W.A Final, December 1984)

Solution. Final claim—Agreed Price—Escalation Claim.

or Rs. 1,77,360—Rs. 1,75,000 Rs. 2,360.

This escalation claim of Rs. 2,360 includes variation for both quantity and price. Escalation clause is applicable to variation in price on standard quantity. Therefore, quantity variations should be excluded from this as follows :

Quantity variance to be excluded	Price variance to be claimed
Materials : $(AQ - SQ) \times A \text{ Rate}$	Material : $SQ \times (A \text{ Rate} - \text{Std. Rate})$
A— $(5050 \text{ kg} - 5000 \text{ kg}) \times \text{Rs. } 4.80$ = Rs. 240	A— $5000 \text{ kg} \times (4.80 - 5.00)$ = (—) Rs. 1,000
B— $(3450 \text{ kg} - 3500) \times \text{Rs. } 7.90$ = (—) 395	B— $3500 \text{ kg} \times (7.90 - 8.00)$ = (—) Rs. 350
C— $(2600 \text{ lt} - 2500 \text{ lt}) \times \text{Rs. } 6.60$ = (+) 660	C— $2500 \text{ lt} \times (6.60 - 6.00)$ = (+) Rs. 1,500
(+) Rs. 505	(+) Rs. 150
Wages : $(A. \text{ Hrs} - \text{Std Hrs}) \times \text{Std Rate}$	Wages : $\text{Std Hrs} (A. \text{ Rate} - \text{Std Rate})$
P— $(2100 - 2000) \times \text{Rs. } 7.20$ = (+) 720	P— $2000 \text{ hrs.} \times (7.20 - 7.00)$ = (+) 400
Q— $(2450 - 2500) \times \text{Rs. } 7.50$ = (—) 375	Q— = Nil
R— $(3100 - 3000) \times \text{Rs. } 6.60$ = (+) 660	R— $3000 \text{ hrs.} \times (6.60 - 6.50)$ = (+) 300
(+) 1,005	(+) 700
Total quantity Variance 1,510	Total Price Variance 850

Agreed Claim	Rs. 1,75,000
Escalation (Admissible)	850
Final price payable	1,75,850

Escalation Clause—Final claim

Problem 5-26. The escalation clause of a long-term contract stipulates the following quantities and rates of materials of A, B and C and following number of labour hours of X, Y and Z and their rates of pay. The actuals are shown below :

			<i>Actual</i>	
<i>Materials</i>	<i>Qty Tonnes</i>	<i>Rate Rs.</i>	<i>Qty Tonnes</i>	<i>Rate</i>
A	500	50	750	45
B	1,000	30	900	35
C	20	1,000	21	1010
<i>Labour</i>	<i>Hours</i>	<i>Hourly rate</i>	<i>Hours</i>	<i>Hourly rate</i>
X	4,800	2'00	4,500	2'25
Y	2,400	1'00	3,000	1'50
Z	9,600	1'50	10,000	1'50

Compute the amount of the final claim so far as rate is concerned.
(I.C.W.A. Final, June 1987)

Solution. Statement showing materials and wages escalation of a long-term contract

<i>Materials</i>	<i>As per contract</i>		<i>Actual Rate</i>	<i>Variation in Rate ÷ or —</i>	<i>Materials Escalation claim 2 × 5</i>
	<i>Qty.</i>	<i>Rate</i>			
(1)	(2)	(3)	(4)	(5)	(6)
A	500 tc.	Rs. 50	Rs. 45	— Rs. 5	— 2,500
B	1,000	30	35	÷ 5	+ 5,000
C	20	1000	1010	÷ 10	+ 200
Materials escalation					+ 2,700

<i>Labour</i>	<i>As per contract</i>		<i>Actual Rate</i>	<i>Variation in Rate + or —</i>	<i>Wages Escalation Claim 2 × 5</i>
	<i>Hours</i>	<i>Rate</i>			
(1)	(2)	(3)	(4)	(5)	(6)
X	4,800	Rs. 2'00	2'25	+ 0'25	+ 1200
Y	2,400	1'00	1'50	+ 0'50	+ 1200
Z	9,600	1'50	1'50	—	—

UNIT COSTING, JOB COSTING AND CONTRACT COSTING

Wages escalation	+2,400
Final escalation claim	+5,100

Add : Claim as per contract

Material	Qty	Rate	Total	
A	500 te.	Rs. 50	Rs. 25,000	
B	1000	30	30,000	
C	20	1000	20,000	
Total			Rs. 75,000	
Labour				
X	4800 Hrs.	2.0	Rs. 9,600	
Y	2400	1.0	2,400	
Z	9600	1.50	14,400	26,400
				1,01,400
Final claim				1,06,500

Problem 5.27 (Escalation Clause). Deluxe Limited undertook a contract for Rs. 5,00,000 on 1st July 1986. On 30th June 1987, when the accounts were closed, the following details about the contract were gathered :

Materials Purchased	Rs. 1,00,000
Wages Paid	45,000
General Expenses	10,000
Plant Purchased	50,000
Materials on hand 30-6-87	25,000
Wages Accrued 30-6-87	5,000
Work Certified	2,00,000
Cash Received	1,50,000
Work Uncertified	15,000
Depreciation of Plant	5,000

The above contract contained an escalation clause which read as follows :

"In the event of prices of materials and rates of wages increase by more than 5% the contract price would be increased accordingly by 25% of the rise in the cost of materials and wages beyond 5% in each case."

It was found that since the date of signing the agreement the prices of materials and wage rates increased by 25%. The value of the work certified does not take into account the effect of the above clause.

Prepare the contract account. Workings should form part of the answer.

(C.A. Inter, November 1987)

Solution : **Contract Account of Deluxe Limited**
(For the year ending 30th June 1987)

To Materials	Rs. 1,00,000	Work in Progress A/c :	
.. Wages Paid 45,000		Work Certified	Rs. 2,00,000
.. Accrued 5,000	50,000	Work uncertified	15,000
		Materials in hand	25,000

„ G. Exp.	10,000	Contract	5,000
„ Plant Depreciation	5,000	escalation (Note 1)	
„ Balance c/d (Notional profit)	80,000		
	<hr/> 2,45,000		<hr/> 2,45,000
„ P&L A/c (Note 2)	20,000	By Balance b/d	80,000
„ Work-in-progress	60,000		
	<hr/> 80,000		<hr/> 80,000

**Note 1—Calculation of escalation
Material Wages increased by 25%**

(a) Increase in material price

$$(Rs. 1,00,000 - Rs. 25,000) \times (25/125) \quad Rs. 5,000$$

(b) Increase in wages

$$Rs. 50,000 \times (25/125) \quad 10,000$$

Total increase

$$15,000$$

It is 5% of contract price.

Escalation is 25% of the rise in the cost of material and wages beyond 5% in each case.

$$\therefore 25\% \text{ increase} = Rs. 25,000$$

$$5\% \text{ increase} = 5,000$$

$$\therefore \text{Escalation} = 25\% \text{ of } (Rs. 25,000 - Rs. 5,000) = Rs. 5,000$$

Note 2. Profit to be credited to P & L A/c

$$\text{Profit} = \frac{1}{3} \times \frac{\text{Cash received}}{\text{Work certified}} \times \text{Notional Profit}$$

$$= \frac{1}{3} \times \frac{1,50,000}{2,00,000} \times 80,000 = Rs. 20,000$$

Since contract completion is less than 50%, only 1/3rd profit as restricted by ratio of cash received to work certified is transferred to P & L A/c.

Authors' Special Notes

1. Refer to Problem 5:3. Interpret and note the wording "*Factory overhead expenses should be allocated to each brand on the basis of units, which could have been produced in a month, when single brand production was in operation*". Collect similar examples.

2. Refer to Problems 5:14 and 5:15. When pipes of different sizes are produced, remember that input is the same and output is of different sizes. Find material cost per metre and conversion cost per metre to determine the cost of different sizes.

**BREAK-UP OF THE PROBLEMS RELATING TO JOB COSTING
AND CONTRACT COSTING ACCORDING TO DIFFERENT
LEVELS (FOR PROBLEMS WITH PREFIX A, REFER
TO APPENDIX A)**

Intermediate Level

Cost Sheet—P 5-1, 5-2, 5-6, 5-7, 5-8, A 41, A 103, A 167

Production Account—P 5-10

Job Costing—P 5-11, 5-12, 5-16, 5-17, 5-18, 5-19, A 78

Contract Costing—P 5-20, 5-22, 5-23, 5-24, 5-27, 5-28, A 63 A 160

Final Level

Cost Sheet—P 5-4, 5-5, A 9

Production Account—P 5-9

Job Costing—P 5-13, 5-14, 5-15

Contract Costing—P 5-21

Escalation clause—P 5-25, 5-26

Please also refer to the Examples 6-1 to 6-11 of the book "Advanced Cost and Management Accounting—Text" by Saxena and Vashist.

Process Costing

[Treatment of normal and abnormal losses/effectiveness 6·1--6·12,
Equivalent Production 6·13--6·21, Inter-process Profits 6·22--6·23]

TREATMENT OF NORMAL AND ABNORMAL LOSSES/EFFECTIVENESS

Abnormal loss/gains accounts after adjusting scrap value

Problem 6.1. Product X is obtained after it is processed through three distinct processes. The following cost information is available for the operation.

	Total	Process		
		I	II	III
Materials	Rs. 5,625	Rs. 2,600	Rs. 2,000	Rs. 1,025
Direct Wages	7,330	2,250	3,680	1,400
Production Overheads	7,330	—	—	—

500 units @ Rs. 4/- per unit were introduced in Process I. Production Overheads are absorbed as a percentage of Direct Wages.

The actual output and normal loss of the respective processes are :

	Output Units	Normal loss on Input	Value of scrap unit Rs.
Process I	450	10%	2
Process II	340	20%	4
Process III	270	25%	5

There is no stock or work-in-progress in any process show :

(i) the three process accounts

(ii) the abnormal loss and abnormal gain accounts.

(F.C.W.A. Inter, Dec. 1986 ; Dec. 1979 & C.A. (F) May 1985, Modified)

Solution

Process I Account

	Units	Amount		Units	Amount
To units introduced					
@ Rs. 4	500	Rs. 2,000	By normal loss	50	Rs. 100
„ Materials		2,600	@ Rs. 2		
„ Labour		2,250	„ Transfer to		
„ Production Over-			Process II		
heads (100% of D.W.)		2,250	@ Rs. 20	450	9,000
	<u>500</u>	<u>9,100</u>		<u>500</u>	<u>9,100</u>
	==	==		==	==

Process II Account

	Units	Amount		Units	Amount
To Transfer from Process I	450	9,000	By Normal loss		
„ Materials		2,000	@ Rs. 4	90	Rs. 360
„ Labour		3,680	„ Abnormal loss		
„ Production Over-heads (100% of D.W.)		3,680	@ Rs. 50*	20	1,000
			„ Transfer to Process III		
			@ Rs. 50	340	17,000
	<u>450</u>	<u>18,360</u>		<u>450</u>	<u>18,360</u>
	==	==		==	==

Process III Account

	Units	Amount		Units	Amount
To Transfer from Process II	340	17,000	By normal loss		
„ Materials		1,025	@ Rs. 5	85	Rs. 425
„ Labour		1,400	„ Finished goods		
„ Production Overheads		1,400	@ Rs. 80	270 *	21,600
„ Abnormal gain @ Rs. 80**	15	1,200			
	<u>355</u>	<u>22,025</u>		<u>355</u>	<u>22,025</u>
	==	==		==	==

* (Rs. 18,360 - 360) ÷ 360 = Rs. 50

** (Rs. 20,825 - 425) ÷ 255 = Rs. 80

Abnormal Loss Account

	Units	Amount		Units	Amount
To Process II	20	1,000	By sales proceeds of scrap @ Rs. 4	20	Rs. 80
			„ Costing P & L A/c		920
	<u>20</u>	<u>1,000</u>		<u>20</u>	<u>1,000</u>
	==	==		==	==

By Abnormal Gain Account

To Normal loss @ Rs. 5	15	Rs. 75	By Process III	15	Rs. 1,200
„ Costing P & L A/c		1,125			
	<u>15</u>	<u>1,200</u>		<u>15</u>	<u>1,200</u>
	==	==		==	==

Computation of Standard Cost/profit with normal loss

Problem 6.2. ABC Ltd. is producing the product 'P' required to be processed in three continuous processes. They have laid down the standards to produce 75 litres of finished product as under :

	Process Number		
	(1)	(2)	(3)
Raw materials (litres)	100	—	—
Material cost per litre (Rs.)	2	—	—
Waste percentage on input (%)	10	11.11	6.25
Direct labour hours (hrs.)	6	10	8
Wage rate per hour (Rs.)	7.5	10	12.50
Overhead rate per labour hr. (Rs.)	3.5	3	8
Sale price per litre of finished product (Rs.)	—	—	9

You are required to prepare the statement of standard cost and standard profit rate per 75 litres of finished product.

(C.S. Final, Dec. 1986)

Solution.		Process 1			
	Qty	Rs.		Qty	Rs.
To Raw Mat.			By Normal loss	10	—
(100 × Rs. 2)	100	200	By Process 2	90	266
„ D.L. (7.5 × 6)		45			
„ Overhead					
(6 × 3.5)		21			
	100	266		100	266
	==	==		==	==
Process 2					
To Process 1	90	266	By Normal loss	10	—
„ Labour (10 × 10)		100	„ Process 3	80	396
„ Overhead					
(10 × 3)		30			
	90	396		90	396
	==	==		==	==
Process 3					
To Process 2	80	396	By Normal loss	5	—
„ Labour			„ Finished Goods	75	560
(12.50 × 8)		100			
„ Overhead (8 × 8)		64			
	80	560		80	560
	==	==		==	==
P & L A/c					
To Finished Goods			By Sales	75	675
A/c	75	560			
„ P & L A/c		115			
	75	675		75	675
	==	==		==	==

Abnormal loss/gain Account by adjusting Scrap value (Material added in the process)

Problem 6.3. A product is manufactured by passing through three processes A, B and C. In process C, a by-product is also produced which is then transferred to process D where it is completed. For the first week in October, actual data included :

Process	A	B	C	D
Normal loss of input	5%	10%	5%	10%
Scrap value (per unit)	Rs. 1.50	Rs. 2.00	Rs. 4.00	Rs. 2.00
Estimated sales value of by-product (per unit)	—	—	Rs. 8.00	—
Output (units)	5,760	5,000	4,370	—
Output of by-product (units)	—	—	510	450
Direct materials (6,000 units) Rs. 12,000				
Direct materials added in process	5,000	9,000	4,000	220
Direct wages	4,000	6,000	2,000	200
Direct expenses	800	1,680	2,260	151
Budgeted production overhead for the week				Rs. 30,500
Budgeted direct wages for the week				Rs. 12,200

You are required to prepare :

- (a) accounts for Processes A, B, C and D.
 (b) abnormal loss account and abnormal gain account.

(C.I.M.A. London, Nov. 1986 Adapted)

Note. Name of ICMA (London) has now been changed to CIMA (London).

(a) **Solution.**

Process A Account

	Units	Price per unit	Amount		Unit Price	Amount
					per unit	
To Direct Material	6,000	Rs. 2	Rs. 12,000	By Normal loss (Scrap A/c)	300 1.50	450
„ Direct material added			5,000	Process B	5,760 5.50	31,680
„ Direct wages			4,000			
„ Direct expenses			800			
.. Production overhead (250*% of Direct wages)			10,000			
„ Abnormal gain A/c	60	5.50	330			
	6,060		32,130		6,060	32,130

*Rs. 30,500 / 12,200 = 2.50%

Workings

Costs	31,800	Input	6,000
Less : Scrap	450	Less : Normal loss	300
	<u>31,350</u>		<u>5,700</u>

or Rs. $31,350 \div 5,700$ units = Cost per units Rs. 5.50

(b) Process B Account

	Units	Price per unit	Amount		Units	Price per unit	Amount
To Process A	5,760	5.50	31,680	By Normal loss	576	2.00	1,152
„ Direct materials added			9,000	„ Abnormal loss A/c	84	12.00	1,008
„ Direct wages			6,000	„ Process C	5,100	12.00	61,200
„ Direct expenses			1,680				
„ Production overhead			15,000				
	<u>5,760</u>		<u>63,360</u>		<u>5,760</u>		<u>63,360</u>

Workings

Costs	63,360	Input	5,760
Less : Scrap	1,152	Less : Normal loss	576
	<u>62,208</u>		<u>5,184</u>

or Rs. $62,208 \div 5,184$ units = Cost per unit Rs. 12.00

Process C Account

	Units	Price per unit	Amount		Units	Price per unit	Amount
To Process B	5,100	12	61,200	By Normal loss	255	4	1,020
„ Direct material			4,000	„ Finished Goods A/c	4,370	16	69,920
„ Wages			2,000	„ Process D	510	8	4,080
„ Direct exp.			2,260				
„ Production overhead			5,000				
„ Abnormal Gain A/c	35	16	560				
	<u>5,135</u>		<u>75,020</u>		<u>5,135</u>		<u>75,020</u>

Workings

Cost	74,460	Input	5,100
Less : Scrap	1,020	Less : Normal loss	255
Less : By-product	4,080	Less : By-product	510
	<u>69,360</u>	÷	<u>4,335</u>

= Cost per unit 16

Process D Account

Unit Price			Amount				
	per unit			Unit	per unit	Amount	
To Process C	510	8	4,080	By Normal loss	51	2	102
„ D. Material			220				
„ Wages			200	„ Finished Goods	450	11	4,950
„ D. Exp.-			151				
„ Production overhead				„ Abnormal loss	9	11	99
250% of the wages			500				
	<u>510</u>		<u>5,151</u>		<u>510</u>		<u>5,151</u>

Working :

Cost	5,151	Input.	510
Less : Scrap	102	Less N. loss	51
	<u>5,049</u>	÷	<u>459</u>

= Cost per unit Rs. 11

Abnormal Loss A/c

	Unit	Price	Amount		Unit	Price	Amount
		per				per	
		unit				unit	
To Process B	84	12	1,008	By Scrap	84	2	168
„ Process D	9	11	99	„ Scrap	9	2	18
				„ P & L A/c			921
	<hr/>		<hr/>		<hr/>		<hr/>
	93		1,107		93		1,107
	<hr/>		<hr/>		<hr/>		<hr/>

Abnormal Gain A/c

	Units	Price	Amount		Unit	Price	Amount
	per unit				per unit		
To Scrap	*60	1·50	90	By Process A	60	5·50	330
„ Scrap	*35	4·00	140	„ Process C	35	16·00	560
„ P & L A/c			660				
	<u>95</u>		<u>890</u>		<u>95</u>		<u>890</u>
			==				==

*For reasons of scrap adjustment, refer to 'Advanced Cost Accounting' (now titled "Cost and Management Accounting—Text") by Saxena and Vashist.

Abnormal loss/gain accounts when degree of completion is given.

*Problem 6·4. The following data are available in respect of Process 3 for the month of April :

Direct materials added in process		Rs. 776
Direct labour		386
Production overhead		768
Transfer from Process 2 :	4,200 unit valued at	Rs. 1,560
Transfer to Process 4 :	3,650 units	
Stock at 1st April : 600 units valued at Rs.	390	
Degree of completion :		
materials added in process	60%	
labour	50%	
overhead	40%	
Stock at 30th April : 800 units		
degree of completion :		
Materials added in process	30%	
Labour	70%	
Overhead	60%	
Units scrapped : 350		
Degree of completion :		
Materials added in process	100%	
Labour	80%	
Overhead	80%	

Normal loss is 10% of throughput

All units scrapped can be sold for Rs. 0·10 per unit.

You are required to prepare :

(a) a statement showing the cost per unit of production and the value of the output ;

(b) an account for Process 3 ;

(c) an abnormal loss or abnormal gain account

(C.I.M.A. London, May 1986 adapted)

(FIFO Method)											
Solution			Material 1		Material 2		Labour		Overhead		
Input			(For input from process 2)								
Details	Units	Output	Units	%	Units	%	Units	%	Units	%	Total
Op. Stock	600	N. loss	400*								
		completed									
		From Op. Stock	600		240	40	300	50	360	60	
Process 2	4,200	Fresh	3,050	100	3,050	100	30,50	100	3,050	100	
		Cl. Stock	800	100	640	80	560	70	480	60	
		Ab. Gain	(50)	100	(50)	100	(50)	100	(50)	100	
	4,800		4,800		3,880		3,860		3,840		
Costs.	From Proces 2	Rs. 1,560	Rs.		Rs.		Rs.		Rs.		
	Less: Scrap										
	(400* × 0.10)	40	1,520		776		386		768		3,450
	Cost per unit		0.40		0.20		0.10		0.20		0.90
Evaluation											
Units completed from :											
	Op. Stock				48		30		72		150
	Normal loss										
	Units introduced and completed				610		305		610		2,745
	Cl. Stock				128		56		96		600
	Abnormal Gain				786		391		778		3,495
					(10)		(5)		(10)		(45)
					776		386		768		3,450
					1,520						

* 10% of throughput means 10% of production, i.e. (600 + 4200 - 800)

Process 3 Account

	<u>Units</u>	<u>Amount</u>		<u>Units</u>	<u>Amount</u>
To Op. Stock	600	Rs. 390	By Normal loss	400	40
„ Process 2	4,200	1,560	By Process 4	3650	3285*
„ Material (introduced in process 3)		776	„ Cl. Stock	800	600
„ Labour		386			
„ Overhead		768			
„ Abnormal Gain	50	45			
	<u>4,850</u>	<u>3,925</u>		<u>4,850</u>	<u>3,925</u>

*Cost already incurred on Op. Stock	Rs. 390
Cost incurred to complete the units representing Op. Stock	150
Cost incurred in completing newly introduced units	2,745
	<u>3,285</u>

Abnormal Gain A/c

	<u>Units</u>	<u>Amount</u>		<u>Units</u>	<u>Amount</u>
To Scrap @ Re. 0·10	50	5	By Process 3	50	45
„ Profit and loss account		40			
	<u>50</u>	<u>45</u>		<u>50</u>	<u>45</u>

Computation of manufacturing Cost and Cost of Scrap and Waste

Problem 6·5. A product which uses 100 tonnes as input per month passes through two processes. The details of cost in process I for April 1987 are :

<i>Process I</i>	<i>Cost per tonne</i>
Direct material cost	Rs. 26,100
Direct labour cost	7,800
Overhead	13,500

The total loss in process I is 2% of input, and the scrap is 8% of input with a value of Rs. 12,000 per tonne.

The material is transferred to process II at cost. The process direct labour cost at Process II is Rs. 9,000 per tonne of input. The overhead is 60% of direct labour cost. The scrap at Process II is 20% of input with a value of Rs. 12,000 per tonne. Draw up a cost

sheet to present the manufacturing cost of the product showing clearly the cost of scrap and waste at each stage of manufacturing.

(C.S. Inter, June 1987)

Solution		Process Cost Sheet		
Process I	Tonnes	Cost per Tonne	Total	
Input :				
Direct material	100	Rs. 26,100	Rs. 26,10,000	
Direct labour		7,800	7,80,000	
Overhead		13,500	13,50,000	
Total	100	47,400	47,40,000	
Less : Loss 2%	2	—		
Scrap 8%	8	12,000	96,000	
Output (To process II)	90	51,600	46,44,000	
Process II	Tonnes	Cost per Tonne	Total	
From process I	90	51,600	46,44,000	
Direct Labour		9,000	8,10,000	
Overhead (60% Labour Cost)		5,400	4,86,000	
Total	90	66,000	59,40,000	
Less Scrap 20% of Input	18	12,000	2,16,000	
Output (Finished)	72	79,500	57,24,000	

Finding out wastage of one of the processes

Problem 6.6. A product passes through three processes—A, B and C. 10,000 units at a cost of Rs. 1.10 were issued to process A. The other direct expenses were as follows :

	Process A	Process B	Process C
Sundry materials	Rs. 1,500	Rs. 1,500	Rs. 1,500
Direct Labour	4,500	8,000	6,500
Direct expenses	1,000	1,000	1,500

The wastage of process A was 5% and in process B 4%. The wastage of process A was sold at Re. 0.25 per unit and that of B at Re. 0.50 per unit and that of C at Re. 1.00 per unit.

The overhead charges were 160% of direct labour. The final product was sold at Rs. 10 per unit fetching a profit of 20% on sales. Find out the percentage of wastage in process C

(ICWA Final, June 1985, R.S.)

Solution			Process A A/c		
	Units	Rate	Amount		Units Rate Amount
To units introduced	10,000	110	11,000	By wastage A/c 5%	500 0.25 125
„ S. Material			1,500	„ Process B	9,500 2.639 25,075
„ D. Labour			4,500		
„ D. Expenses			1,000		
„ Overhead (160% of D.L.)			7,200		
	<u>10,000</u>		<u>25,200</u>		<u>10,000 25,200</u>
Process B A/c					
	Units	Rate	Amount		Units Rate Amount
To Process A	9,500	2.639	25,075	By Wastage A/c (4%)	380 0.50 190
„ Material			1,500	„ Process C A/c	9,120 5.283 48,185
„ Labour			8,000		
„ D. Exp.			1,000		
„ Overhead (160% of D.L.)			12,800		
	<u>9,500</u>		<u>48,375</u>		<u>9,500 48,375</u>
Process C A/c					
	Units	Rate	Amount		Units Rate Amount
To Process B A/c	9,120	5.283	48,185	By Wastage A/c 7.63% of 9,120	696* 1.00 696
„ D. Material			1,500		
„ D. Labour			6,500	By Finished stock A/c	8,424 8.00 67,392
„ D. Exp.			1,503		
„ Overhead (160% of D.L.)			10,400		
	<u>9,120</u>		<u>68,088</u>		<u>9,120 68,088</u>

Calculation of wastage

Selling Price per unit = Rs. 10.00

Less Profit (20% of S.P.) = 2.00

Cost price = 8.00

Suppose wastage = W units

(9,120 - W) 8 = Rs. 68,088 - (W × Re 1) or W = 696 units

Wastage is 696 units

Wastage as % of input $(696 \div 9120) \times 100 = 7.63\%$

Process and Stock Account (Weighted Average)

Problem 6-7. The product of a manufacturing unit passes through two distinct processes. From past experience the incidence of wastage is ascertained as under :

Process A	2 per cent
Process B	10 per cent

In each case the percentage of wastage is computed on the number of units entering the process concerned. The sales realisation of wastage in Process A and B are Rs. 25 per 100 units and Rs. 50 per 100 units respectively.

The following information is obtained for the month of April 1985 : 40,000 units of crude material were introduced in process A at a cost of Rs. 16,000.

	Process A	Process B
Other Material	Rs. 16,000	Rs. 5,000
Direct Labour	9,000	8,000
Direct Expenses	8,200	1,500
	<hr/>	<hr/>
	Units	Units
Output	39,000	36,500
Finished Product Stock :		
April 1	6,000	5,000
April 30	5,000	8,000
	<hr/>	<hr/>
Value of Stock per unit on	Rs.	Rs.
April 1st	1.20	1.60
	<hr/>	<hr/>

Stocks are valued and transferred to subsequent process at weighted average costs.

Prepare respective Process Accounts and Stock Accounts.

(C.W.A. Inter, June, 1985)

Solution.

Solution.			Process A A c				
	Units	Rate	Amount		Units	Rate	Amount
			Rs.				Rs.
To Units introduced	40,000	0.40	16,000	By Normal loss (2% of 40,000)	800	0.25	200
To Material			16,000	By Abnormal loss	200	1.25 *	250
„ Labour			9,000	„ Finished stock	39,000	1.25 *	48,750
„ D. Exp.			8,200				
	<hr/>		<hr/>		<hr/>		<hr/>
	40,000		49,200		40,000		49,200
	<hr/>		<hr/>		<hr/>		<hr/>

*Cost per unit for output and abnormal loss = $(Rs. 49,200 - Rs. 200) \div (40,000 - 200) = 49,000 \div 39,200 = Rs. 1.25$.

Process A Stock A/c

	Units	Rate	Amount		Units	Rate	Amount
To Op. Stock	6,000	1.20	7,200	By Process B			
„ Process A	39,000	1.25	48,750	A/c	40,000	1.2433*	49,733
				„ Balance	5,000	1.2433	6,217
				(Cl. stock)			
	45,000		55,950		45,000		55,950

*Weighted average cost = Rs. 55,950 ÷ 45,000 units = Rs. 1.2433 per unit.

Process B A/c

	Units	Rate	Amount		Units	Rate	Amount
To Process A	40,000	1.2433	49,733	By Normal loss	4,000	0.50	2,000
Stock A/c				(10% of 40,000)			
To Material			5,000	By Process B	36,500	1.7287	63,097
„ Labour			8,000	stock A/c			
„ D. Exp.			1,500				
„ Abnormal gain A/c	500	1.7287	864				
	40,500		65,097		40,500		65,097

Cost per unit of output and abnormal gain for Process B
 (Rs. 64,233 - Rs. 2,000) ÷ (40,000 - 2,000) = Rs. 62,233 ÷ 38,000 units
 = Rs. 1.7287.

Process B Stock A/c

	Units	Rate	Amount		Units	Rate	Amount
		Rs.	Rs.			Rs.	Rs.
To Op. Stock	5,000	1.60	8,000	By Finished			
„ Process B	36,500	1.7827	63,097	stock A/c	33,500	1.7132	57,392
				„ Cl. Stock	8,000	1.7132	13,705
	41,500		71,097		41,500		71,097

*Weighted average cost = Rs. 71,097 ÷ 41,500 units = Rs. 1.7132

Note : This working should be compared with the working for a problem following simple average method.

† **Problem 6-8 (Normal/Abnormal Loss or Gain).** A product passes through three processes viz., Process I, Process II, Process III. The normal wastage of each process is:

Process I : 3%; Process II : 6%; and Process III : 10%.

The percentage of normal wastage in each case is computed on the basis of the number of units entering the process concerned. The wastage

of Process I is sold @ 25 paise per unit, that of Process II is sold @ 50 paise per unit, and that of Process III is sold @ Re. 1 per unit. 15,000 units of crude material were introduced in Process I @ Re. 1 per unit. The other expenses are :

	Process I	Process II	Process III
Material consumed Rs.	1,500	Rs. 2,250	Rs. 750
Direct labour	7,500	12,000	9,750
Manufacturing Exp.	1,575	1,425	3,015

The output of each process has been as follows :

Process I	—	14,250
Process II	—	13,650
Process III	—	12,012.

Prepare process cost accounts and abnormal wastage and abnormal effective accounts.
(C.S. Inter, December 1987)

Solution.

Process I Account

Particulars	Units	Amount	Particulars	Units	Amount
		Rs.			
To Raw Material	15,000	15,000.00	By Normal		
„ Material		1,500.00	Wastage 3%		
„ Direct Labour		7,500.00	@ Re. 0.25		
„ Mfg. Exp.		1,575.00	per unit	450	112.50
			„ Abnormal		
			Wastage @		
			Rs. 1.75 per		
			unit*	300	525.00
			„ Process II A/c		
			@ Rs. 1.75		
			per unit*	14,250	24,937.50
	15,000	25,575.00		15,000	25,575.00
	=====	=====		=====	=====

$$* [(Rs. 25,575 - Rs. 112.50) \div (15,000 - 450)] = Rs. 1.75 \text{ per unit}$$

Process II Account

Particulars	Units	Amount	Particulars	Units	Amount
To Process I A/c	14,250	24,937.50	By Normal		
„ Material		2,250.00	Wastages 6%		
„ Direct Labour		12,000.00	@ Re. 0.50		
„ Mfg. Exp.		1,425.00	per unit	855	427.50
„ Abnormal			„ Process III		
Gain A/c			@ Rs. 3.00 per		
@ Rs. 3 per			unit*	13,650	40,950.00
unit *	255	765.00			
	14,505	41,377.50		14,505	41,377.50
	=====	=====		=====	=====

$$*[(24,937.50 + 2,250 + 12,000 + 1,425 - 427.50) \div (14,250 - 855)]$$

$$= \text{Rs. 3 per unit}$$

Process III Account

<i>Particulars</i>	<i>Units</i>	<i>Amount</i> <i>Rs.</i>	<i>Particulars</i>	<i>Units</i>	<i>Amount</i> <i>Rs.</i>
To Process II A/c	13,650	40,950.00	By Normal		
„ Material		750.00	Wastage 10%	1,365	1,365.00
„ Direct Labour		9,750.00	„ Abnormal		
„ Mfg. Exp.		3,015.00	Wastages		
			Rs. 4.322**	273	1,180.00
			„ Finished		
			Goods A/c		
			Rs. 4.322 **	12,012	51,920.00
	<u>13,650</u>	<u>54,465.00</u>		<u>13,650</u>	<u>54,465.00</u>
	=====	=====		=====	=====

$$** [(Rs. 54,465 - Rs. 1,365) \div (13,650 - 1,365)] = \text{Rs. 4.322}$$

Abnormal Wastage Account

	<i>Units</i>	<i>Rs.</i>		<i>Units</i>	<i>Rs.</i>
To Process I A/c	300	525.00	By Cash		
„ Process III A/c	273	1,100.00	300 × Re. 0.25		
			= Rs. 75.00		
			273 × Re. 1.00		
			= Rs. 273.00	573	348.00
			„ Costing P & L		
			A/c		1,357.00
	<u>573</u>	<u>1,705.00</u>		<u>573</u>	<u>1,705.00</u>
	=====	=====		=====	=====

Abnormal Effectiveness Account

	<i>Units</i>	<i>Rs.</i>		<i>Units</i>	<i>Rs.</i>
To Normal			By Process II A/c	255	765.00
Wastage					
@ Re. 0.50	255	127.50			
„ Costing P & L					
A/c		637.50			
	<u>255</u>	<u>765.00</u>		<u>255</u>	<u>765.00</u>
	=====	=====		=====	=====

Normal Wastage A/c

	<i>Units</i>	<i>Rs.</i>		<i>Units</i>	<i>Rs.</i>
To Process I A/c	450	112.50	By Abnormal		

P6'16

COST AND MANAGEMENT ACCOUNTING

„ Process II A/c	855	427.50	Effectiveness		
„ Process III			A/c	255	127.50
A/c	1,365	1,365.00	„ Bank	2,415	1,777.50
	<u>2,670</u>	<u>1,905.00</u>		<u>2,670</u>	<u>1,905.00</u>

Computation of Productwise Profit & Loss Account (Marginal costing & Absorption costing)

***Problem 6'9.** A company manufactures four products from an input of a raw material to Process 1. Following this process, product *A* is processed in Process 2, product *B* in Process 3, product *C* in Process 4 and product *D* in Process 5.

The normal loss in Process 1 is 10% of input, and there are no expected losses in the other processes. Scrap value in Process 1 is Re. 0.50 per litre. The costs incurred in Process 1 are apportioned to each product according to the volume of output of each product. Production overhead is absorbed as a percentage of direct wages.

Data in respect of the month of October

	<i>Process</i>					Total
	1	2	3	4	5	
	Rs. 000	Rs. 000	Rs. 000	Rs. 000	Rs. 000	Rs. 000
Direct materials at Rs. 1.25 per litre	100					100
Direct Wages	48	12	8	4	16	88
Production Overhead						66

	<i>Product</i>			
	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>
	<i>litres</i>	<i>litres</i>	<i>litres</i>	<i>litres</i>
Output	22,000	20,000	10,000	18,000
	Rs.	Rs.	Rs.	Rs.
Selling Price	4.00	3.00	2.00	5.00
Estimated sales value at end of				
Process 1	2.50	2.80	1.20	3.00

You are required to :

(a) Calculate the profit or loss for each product for the month assuming all output is sold at the normal selling price.

(b) Suggest and evaluate an alternative production strategy which would optimise profit for the month. It should not be assumed that the output of process 1 can be changed.

(c) Suggest to what management should devote its attention, if it is to achieve the potential indicated in (b)

[I.C.M.A.(London), November 1984—Adapted]

	(Rs. in thousands)				
	A	B	C	D	Total
Sales value after further processing	88	60	20	90	258
Sales value before further processing	55	56	12	54	177
Change in value	33	4	8	36	81
Post-separation cost [Refer to table under (a)]	21	14	7	28	70
	12	(10)	1	8	11

Proposed strategy. Product B incurs loss after separation point. For this reason, product B should not be processed further, while other products should be processed further. This strategy will enhance company's profit as follows :

	(Rs. in thousands)				
	A	B	C	D	Total
Sales	88	56	20	90	254
Post-separation cost	21	—	7	28	56
	67	56	13	62	198
Pre-separation costs					175
Additional profit					23

Therefore, company will be benefited by selling only Product B at separation point.

Raw materials requirement when final total output is given

Problem 6'10. In a manufacturing unit, raw material passes through four processes I, II, III & IV and the output of each process is the input of the subsequent process. The loss in the four processes I, II, III & IV are respectively 25%, 20%, 20% and 16½% of the input. If the end product at the end of Process IV is 40,000 kg, what is the quantity of raw material required to be fed at the beginning of Process I and the cost of the same at Rs. 5 per kg ?

Find out also the effect of increase or decrease in the material cost of the end-product for variation of every rupee in the cost of the raw material.

(C.A. Inter, Nov. 1984)

Solution.

Suppose output in Process I = 100 kg.

Statement of production in different processes based on input of 100 kg. in Process I.

	Process II	Process III	Process IV
	60 kg.	60 kg.	48 kg.
	20%	20%	16½%

	Process I	Process II	Process III	Process IV
Loss in kg.	25 kg.	15 kg.	12 kg.	8 kg.
Output in kg.	75 kg.	60 kg.	48 kg.	40 kg.

If output in process IV is 40 kg, input in process I = 100 kg.

" " " " " is 40,000 kg. input in process I

$$= (40,000 \times 100) \div 40 \text{ or } 1,00,000 \text{ kg.}$$

Cost of raw material required = 1,00,000 kg. \times Rs. 5 = Rs. 5,00,000.

Effect : The input is 2.5 times of the final output. Therefore, for variation of every rupee in the cost of R.M., the final effect will be Rs. 2.50.

Determination of initial input when final output is given

• Problem 6.11. An article passes through three successive operations from the raw material to the finished product stage. The following data are available from the production records of a particular month.

Operation No.	No. of pieces input	No. of pieces rejected	No. of pieces output
1	60,000	20,000	40,000
2	66,000	6,000	60,000
3	48,000	8,000	40,000

(i) Determine the input required to be introduced in the first operation in number of pieces in order to obtain finished output of 100 pieces after the last operation.

(ii) Calculate the cost of raw material required to produce one piece of finished product, given the following :

Weight of the finished piece is 0.10 kg. and the price of raw material is Rs. 20 per kg. (C.A. Inter, May 1982)

Solution : (i) **Statement of Input, Rejections and Output**

Operation No.	Input (No.)	Rejections (No.)	Output (No.)	Rejections as % of input	Rejections as % of output
1	60,000	20,000	40,000	33 $\frac{1}{3}$	50%
2	66,000	6,000	60,000	9 $\frac{1}{5}$	10%
3	48,000	8,000	40,000	16 $\frac{2}{3}$	20%

The input required to be introduced in the first operation for finished output of 100 pieces will be as follows :

	Pieces
Output of operation No. 3	100
Rejections of operation No. 3 on output (20%)	20
Output of operation No. 2	120
Rejections on output (10%)	12

Output of operation No. 1	132
Rejections on output (50%)	66

Input at the beginning of operation No. 1 198

For an output of 100 pieces, 198 pieces are required.

(ii) Input of raw material required for one finished piece will be as follows

$$= (0.10 \text{ kg.} \times 198) \div 100 = 0.198 \text{ kg.}$$

Cost of raw material

$$\begin{aligned} @ \text{Rs. } 20 \text{ per kg.} &= 0.198 \times 20 \\ &= \text{Rs. } 3.96 \text{ per finished piece.} \end{aligned}$$

Computation of Unit Standard and Actual Process Cost (Price variance being nil)

• **Problem 6.12.** A product passes through two consecutive processes having relative standard outputs of 80% and 90% of inputs. In addition, standard yield is obtained by giving scrap allowances of 10% and 5% of outputs of Process I and II respectively. Scraps of each process are sold at Rs. 1,000 per tonne.

There was no work-in-process at any stage. All materials, as follows, were issued in Process I only and all scrap arising from processes were sold, excepting closing stock of 10 tonnes (opening stock was nil).

Material issues :	'A' 100 tonnes	@ Rs. 2,000 per tonne
	'B' 400 "	@ " 1,500 "
	'C' 500 "	@ " 1,200 "

The actual outputs and scraps were 85% and 8% in Process I and 80% and 10% in Process II. Assume that there was no price variance.

You are required to find out the Standard Cost and Actual Cost per tonne of a product. (Answers to be given in the nearest rupee).

(I.C.W.A. Inter, June 1984)

Solution.

(a) Consumption of material

Particulars	Tonnes	Rate (Rs.)	Value (Rs.)
Material Issues			
'A' class	100	2,000	2,00,000
'B' class	400	1,500	6,00,000
'C' class	500	1,200	6,00,000
	<u>1,000</u>		<u>14,00,000</u>
Less : Closing Stock*	10	1,000	<u>10,000</u>
			<u>13,90,000</u>

* It is assumed that closing stock of scrap can be sold at a given price of Rs. 1,000 per tonne.

(b) Production Particulars

		<i>(Quantities in tonne)</i>		
	%	Standard	%	Actual
Input in Process I	100	1,000	100	1,000
Output to Process I	80	800	85	850
Less : Scrap	(10% of 800)	80	(8% of 850)	68
Yield of Process I (transferred)		720		782
Input to Process II	100	720	100	782
Output to Process II	90	648	80	625.60
Less : Scrap	(5% of 648)	32.40	(10% of 625.6)	62.56
		615.60		563.04

(c) Cost of finished product per tonne*(in Rupees)*

	Standard	Actual
1. Consumption [as given in (a)]	Rs. 13,90,000	Rs. 13,90,000
Less : Scrap sold :		
Scrap in Process I + Scrap in process 2—closing stock of scrap i.e., 102.40 tonne		
@ Rs. 1,000 per tonne	Rs. 1,02,400	Rs. 1,20,560*
Net Cost Total	Rs. 12,87,600	Rs. 12,69,440
2. Yield in finished goods	615.60	563.04
3. Cost of finished product per tonne		
(1 ÷ 2) in nearest rupee)	2,092	2,255

Note : 1. Scrap sold as per standard :

Process I	80.00 tonne
Process II	32.44 tonne

112.40

Less : Closing stock 10.00

Scrap sold (Standard) 102.40

2. *Scrap sold as per actual data :

Process I	68.00	
Process II	62.56	
	<u>130.56</u>	
Less : Closing stock	10.00	
	<u>120.56</u>	Te × Rs. 1,000 = Rs. 1,20,560

EQUIVALENT PRODUCTION**Treatment of Normal/Abnormal waste in Equivalent Production**

Problem 6-13. During the month of April, 1986, 4,000 units were introduced into Process A. The cost of 4,000 units was Rs. 23,200. At the end of the month 3,000 units had been produced and transferred to Process B, 720 units were still in process and 280 units were scrapped. A normal wastage of 5% on inputs is allowed. It was estimated that incomplete units had reached a stage in production as follows :

Material	.....	75% complete
Labour	.....	50% complete
Production overhead	.....	50% complete.

The costs incurred in addition to 4,000 units :

Direct materials	Rs. 6,154
Direct wages	Rs. 13,760
Production overheads	Rs. 6,880.

Units scrapped realised Rs. 2 each and were 100% complete as regards material, labour and overheads.

Prepare the process account and abnormal wastage account.

(C.S. Final, June 1987)

Solution.

Statement showing equivalent production

Input units	Details	Output units	Equivalent production					
			Material		Labour		Overhead	
			Qty.	%	Qty.	%	Qty.	%
4,000	Normal 5% Wastage	200	—	—	—	—	—	—
	Abnormal wastage	80	80	100	80	100	80	100
	Finished	3,000	3,000	100	3,000	100	3,000	100
	Closing Stock	720	540	75	360	50	360	50
<u>4,000</u>		<u>4,000</u>	<u>3,620</u>		<u>3,440</u>		<u>3,440</u>	

Statement of Cost for each element

<i>Elements of cost</i>	<i>Cost</i>	<i>Equivalent Production</i>	<i>Cost per unit</i>
<i>Material</i>	<i>Rs.</i>		<i>Rs.</i>
Cost of units introduced	23,200		
Added in process	6,154		
	<u>29,354</u>		
Less : Value of normal scrap (200 units × Rs. 2)	<u>400</u>		
	28,954	3,620	7 998
Labour	13,760	3,440	4 000
Overhead	6,880	3,440	2 000
			<u>13 998</u>

Statement of Apportionment of process cost

<i>Items</i>	<i>Elements</i>	<i>Equivalent Production (units)</i>	<i>Cost per unit</i>	<i>Cost</i>	<i>Total cost</i>
Units Introduced and completed	Material	3,000	Rs. 7 998	Rs. 23,995	
	Labour	3,000	4 000	12,000	
	Overhead	3,000	2 000	6,000	
					<u>41,995</u>
Abnormal wastage	Material	80	7 998	640	
	Labour	80	4 000	320	
	Overhead	80	2 000	160	
					<u>1,120</u>
Closing Stock	Material	540	7 998	4,319	
	Labour	360	4 000	1,440	
	Overhead	360	2 000	720	
					<u>6,479</u>
					<u>49,594</u>

Process A

	<i>Units</i>	<i>Rs.</i>		<i>Units</i>	<i>Rs.</i>
To Units introduced	4,000	23,200	By N. wastage A/c	200	400
„ Material		6,154	„ Process E	3,000	41,995
„ Labour		13,760	„ Abnormal wastage	80	1,120
„ Overhead		6,880	„ Closing Stock A/c	720	6,479
	<u>4,000</u>	<u>49,994</u>		<u>4,000</u>	<u>49,994</u>

Abnormal Wastage A/c					
To Process A	80	1,120	By Cash	80	160
			„ P & L A/c		960
	80	1,120		80	1,120

Equivalent Production (FIFO Method)—Abnormal Gain

Problem 6.14. The following data pertain to Process 1 for March 1987 of Beta Limited :

Opening Work in Progress 1,500 units at Rs. 17,000

Degree of completion :

Materials 100% ; Labour and Overheads 33½%

Input of Materials 18,500 Units at Rs. 52,000

Direct Labour Rs. 14,000

Overheads Rs. 28,000

Closing Work in Progress 5,000 Units

Degree of Completion Materials 90% and

Labour and Overheads 30%

Normal Process Loss is 10% of total

(Input opening work in progress units = units put in)

Scrap value Rs. 2.00 per unit

Units transferred to the next process 15,000 units.

You are required to :

- Compute equivalent units of production.
- Compute cost per equivalent unit for each cost element, i.e., materials, labour and overheads.
- Compute the cost of finished output and closing work in progress.
- Prepare the process and other Accounts.

Assume : (i) FIFO Method is used by the Company.

(ii) The cost of opening work in progress is fully transferred to the next process. (C A. Inter, May 1987)

Solution. (a) Statement of Equivalent Production

Input (units)	Particulars		Equivalent production			
	Item	Output (units)	Materials		Labour & overhead	
			Units	%	Units	%
1,500	Opening W.I.P.					
18,500	Units introduced					
	Work on					
	Op. W.I.P.	1,500	—	—	1,000	66⅔%
	Units introduced	13,500	13,500	100%	13,500	100%
	and completed					
		15,000				

Normal loss	2,000	—	—	—	—
Closing W.I.P.	5,000	4,500	90%	1,500	30%
	22,000	18,000		16,000	
(—) Abnormal gain	(2,000)	(2,000)	100%	(2,000)	100%
20,000	20,000	16,000		14,000	

(b) Statement showing the cost of each element

Element of cost	Cost	Equivalent units	Cost per unit
Materials	Rs. 52,000		
Less : Scrap value for normal loss	4,000	Rs 48,000	16,000
Labour	14,000	14,000	1
Overheads	28,000	14,000	2

(c) Statement showing cost of finished output and closing W.I.P.

Particulars	Element of cost	Equivalent production	Cost per unit	Cost	Total cost
Cost on W.I.P. already incurred					Rs. 15,000
Opening W.I.P.	Labour	1,000	Rs. 1	Rs. 1,000	
	Overhead	1,000	2	2,000	3,000
Units completed	Material	13,500	3	40,500	
	Labour	13,500	1	13,500	
	Overheads	13,500	2	27,000	81,000
Total cost of 15,000 units					99,000
Closing W.I.P.	Material	4,500	3	13,500	
	Labour	1,500	1	1,500	
	Overheads	1,500	2	3,000	
Total cost of closing W.I.P. (15,000 units)					18,000

Process I Account

<i>Particulars</i>	<i>Units</i>	<i>Amount</i>	<i>Particulars</i>	<i>Units</i>	<i>Amount</i>
To Opening W.I.P.	1,500	15,000	By Normal loss	2,000	4,000
„ Units introduced (Direct materials)	18,500	52,000	„ Transfer to next process	15,000	99,000
„ Direct labour	—	14,000	„ Closing W.I.P.	5,000	18,000
„ Overheads		28,000			
„ Abnormal gain	2,000	12,000*			
	<u>22,000</u>	<u>1,21,000</u>		<u>22,000</u>	<u>1,21,000</u>

Abnormal Gain Account

To Process I A/c (normal loss)	2,000	4,000	By Process I A/c	Rs. 2,000	12,000
„ Costing P & L A/c		8,000			
	<u>2,000</u>	<u>12,000</u>		<u>2,000</u>	<u>12,000</u>

*Balancing figure.

Problem 6-15. From the following particulars extracted from the books of New Colour Ltd. for the month of March 1985, prepare :
(a) Statement of Equivalent Production, (b) Statement of Apportionment of Cost and (c) Process Account :

- Opening Stock as on 1st March
Degree of completion 200 Units @ Rs. 4'00
100% Material
40% Labour & Overhead
- Introduced during March 1,050 Units
- Transfer to next process 1,100 Units
- Closing stock as on 31st March
Degree of completion 150 Units
100% Material
70% Labour & Overheads

Other relevant information regarding the Process Account are :

Material cost	Rs. 3,150
Labour Cost	Rs. 4,500
Production Overhead	Rs. 2,250
	<u>Rs. 9,900</u>

(I.C.W.A. Inter, June 1985)

Solution. (a) Statement of Equivalent Production

<i>Input Units</i>	<i>Items</i>	<i>Output Units</i>	<i>Material</i>		<i>Labour & Overhead</i>	
			<i>Units</i>	<i>%</i>	<i>Units</i>	<i>%</i>
200	Opening Stock					
1,050	Introduced					
	Work on Opening Stock	200	—	—	120	60%
	Units introduced and completed	900	900	100%	900	100%
	Closing Stock	150	150	100%	105	70%
1,250		1,250	1,050		1,125	

Statement of Cost of each element

<i>Element of Cost</i>	<i>Total Cost</i>	<i>Equivalent Unit</i>	<i>Cost per Unit</i>
Material Cost	Rs. 3,150	1,050	Rs. 3'00
Labour Cost	4,500	1,125	4'00
Overhead	2,250	1,125	2'00
	9,900		

(b) Statement of Apportionment of Cost

<i>Item</i>	<i>Element of cost</i>	<i>Equivalent Production</i>	<i>Cost per unit</i>	<i>Cost</i>	<i>Total Cost</i>
Opening stock	Labour	120	4'00	480	Rs. 720
	Overhead	120	2'00	240	
Units Completed	Material	900	3'00	2,700	8,100
	Labour	900	4'00	3,600	
	Overhead	900	2'00	1,800	
Closing Stock	Material	150	3'00	450	1,080
	Labour	105	4'00	420	
	Overhead	105	2'00	210	
					9,900
					===

Dr.		Process Account		Cr.	
<i>Particulars</i>	<i>Units</i>	<i>Amount</i>	<i>Particulars</i>	<i>Units</i>	<i>Amount</i>
To Opening Stock	200	Rs. 800	By Finished Stock	1,100	9,620@
.. Units Introduced	1,050		.. Closing stock	150	1,080
Material		3,150			
Labour		4,500			
Overhead		2,250			
	1,250	10,700		1,250	10,700
@Cost already incurred on opening stock					800
Cost of work done for completing the opening stock					720
Cost of completing newly introduced units					8,100
					9,620

Process Accounts -- Overheads absorbed on mixing labour hours

Problem 6.16. A Company within the food industry mixes produced ingredients in two different processes to produce one product. The output of Process 1 becomes the input of Process 2 and the output of Process 2 is transferred to Packing department.

From the information given below, you are required to open accounts for Process 1, Process 2, abnormal loss and packing department and to record the transactions for the week ended 11th May, 1985

Process 1

Input :

Material A 6,000 kilograms at 50 paise per kilogram

Material B 4,000 kilograms at Rupee 1 per kilogram

Mixing Labour 430 hours at Rs. 2 per hour

Normal loss 5% of weight input, disposed off at 16 paise per of kg.

Output 9,200 kilograms

No work-in-progress at the beginning or at the end of the week.

Process 2

Input :

Material C 6,600 kilograms at 1.25 per kilogram

Material D 4,200 kilograms at Re. 0.75 per kilogram

Flavouring essence Rs. 330.

Mixing labour 370 hours at Rs. 2 per hour.

Normal waste 5% of weight input with no disposal value.

Output 18,000 kilograms.

No work-in-process at the beginning of the week but 1,000 kilograms in process at the end of the week and, estimated to be only 50% complete so far as labour and overhead were concerned.

Overhead of Rs. 3,200 incurred by the two processes to be absorbed on the basis of mixing labour hours.

(C.A. Inter, May 1985)

Solution.**Process 1 A/c**

<i>Particulars</i>	<i>Kg.</i>	<i>Per kg.</i>	<i>Amount</i>	<i>Particulars</i>	<i>Kg.</i>	<i>Per kg.</i>	<i>Amount</i>
		<i>Rs.</i>	<i>Rs.</i>			<i>Rs.</i>	<i>Rs.</i>
To Material A	6,000	0.50	3,000	By Normal loss	500	0.16	80
„ Material B	4,000	1.00	4,000	„ Abnormal loss	300	1.00	300
„ Mixing Labour			860	(Refer to Note 2)			
(430 hours × Rs. 2 per hour)				Process 2	9,200	1.00	9,200
				(Refer to Note 2)			
„ Production overhead (Refer to Note 1)			1,720				
	10,000		9,580		10,000		9,580

Process 2 A/c

	<i>Kg.</i>	<i>Per kg.</i>	<i>Amount</i>		<i>Kg.</i>	<i>Per kg.</i>	<i>Amount</i>
		<i>Rs.</i>	<i>Rs.</i>			<i>Rs.</i>	<i>Rs.</i>
To Process 1	9,200	1.00	9,200	By Normal waste	1,000	—	—
„ Material C	6,600	1.25	8,250	„ Work in Process	1,000	—	1,160
„ Material D	4,200	0.75	3,150	„ Packing Exp.	18,000	1.22	21,960
„ Flavouring essence			300				
„ Mixing labour (370 hours @ Rs. 2 per hour)			740				
„ Overhead (Refer to Note 1)			1,480				
	20,000		23,120		20,000		23,120

Abnormal Loss Account

	Kg	Per kg	Amount		Kg	Per kg	Amount
		Rs.	Rs.			Rs.	Rs.
To Process 1	300	1.00	300	By Sales of Scrap			
				A/c	300	0.16	48
				„ P & L			
				A/c			252
	<u>300</u>		<u>300</u>		<u>300</u>		<u>300</u>

Packing Department A/c

	Kg	Per kg	Amount		Kg	Per kg	Amount
		Rs.	Rs.			Rs.	Rs.
To Process 2				By Balance			
A/c	18,000	1.22	21,960	c/d	18,000	1.22	21,960
	<u>18,000</u>		<u>21,960</u>		<u>18,000</u>		<u>21,960</u>

Note 1. Total Overhead = Rs. 3,200

Total Mixing hours	1 =	430
„ „	2 =	370
		<u>800</u>

Production Overhead Process 1 = $(430 \div 800) \times \text{Rs. } 3,200 = \text{Rs. } 1,720$

Production Overhead Process 2 = $(370 \div 800) \times \text{Rs. } 3,200 = \text{Rs. } 1,480$

Note 2. $\frac{\text{Rs. } 9,580 - \text{Rs. } 80}{10,000 \text{ kg} - 500 \text{ kg}} = \text{Rs. } 1.00$

Note 3. Statement of Equivalent Production

Inputs kg.	Output kg.	Equivalent units					
		Material		Labour		Overhead	
		kg	Units	%	Units	%	Units
9,200	Normal wastage	1,000	—		—		—
6,600	Packing Deptt.	18,000	18,000	100	18,000	100	18,000
4,200	Cl. WIP	1,000	1,000	100	500	50	500
<u>20,000</u>		<u>20,000</u>	<u>19,000</u>		<u>18,500</u>		<u>18,500</u>

**Statement showing cost elementwise
(in Process 2)**

<i>Material</i>	<i>Total cost</i>	<i>Equivalent units</i>	<i>Cost per unit Rs.</i>
Process 1	9,200		
Material C	8,250		
Material D	3,150		
Flavouring essence	300		
	<u>20,900</u>	19,000	1.10
Mixing Labour cost	740	18,500	0.04
Production Overhead	1,480	18,500	0.08
			<u>1.22</u>
			== ==

Cost of units transferred to Packing Deptt

18,000 units × Rs. 1.22 = Rs. 21,960

Cost of WIP

<i>Element</i>	<i>Equivalent units</i>	<i>Cost per unit</i>	<i>Total cost Rs.</i>
Material	1,000	1.10	1,100
Labour	500	0.04	20
Overhead	500	0.08	40
			<u>1,160</u>
			== ==

Problem 6-17. AB Ltd is engaged in Process Engineering Industry. During the month of April 1983, 2,000 units were introduced in process 'X'. The normal loss was estimated at 5% of input. At the end of the month 1,400 units have been produced and transferred to process 'Y', 460 units were incomplete and 140 units, after passing through fully, the entire process had to be scrapped. The incomplete units had reached the following stage of completion :

Material	75% complete
Labour	50% "
Overhead	50% "

Following is the further information on the process 'X' :

Cost of 2,000 units	Rs. 58,000
Additional direct materials	14,400
Direct labour	33,500
Direct overhead	16,700

Unit scrapped realised Rs. 10 each.

Prepare Statement of equivalent production, statement of cost, statement of evaluation and the process 'X' account.

(I.C.W.A. Inter, June 1983; June 1989)

Solution. Statement of Equivalent Production

Input Units	Items Units	Output	Equivalent production			
			Material		Labour & Overhead	
			Units	%	Units	%
—	Op. WIP					
2,000	Introduced					
	Completed	1,400	1,400	100%	1,400	100%
	Normal					
	loss 5%	100	—		—	
	Abnormal loss	40	40	100%	40	100%
	Closing WIP	460	345	75%	230	50%
2,000		2,000	1,785		1,670	

Statement showing the Cost for each Element

Element of cost	Cost	Equivalent unit	Cost per unit
Materials introduced for 2,000 units	Rs. 58,000		Rs
Additional direct materials	14,400		
	72,400		
Less : Scrap realisation (100 × Rs. 10)	1,000		
	71,400	1,785	40
Direct labour	33,400	1,670	20
Direct overhead	16,700	1,670	10
	1,21,500		70

Statement showing Apportionment of Cost

Items	Element	Equivalent units	Cost per unit	Cost	Total
Units completed	Material	1,400	Rs. 40	Rs. 56,000	Rs.
	Labour	1,400	20	28,000	
	Overhead	1,400	10	14,000	
				==	98,000
Abnormal loss	Material	40	40	1,600	
	Labour	40	20	800	
	Overhead	40	10	400	
				==	2,800
Closing W.I.P.	Material	345	40	13,800	
	Labour	230	20	4,600	
	Overhead	230	10	2,300	
				==	20,700
					1,21,500
					==

Dr

Process X Account

Cr.

Particulars	Units	Amount	Particulars	Units	Amount
To Units introduced	2,000	Rs. 58,000	By Normal loss	100	Rs. 1,000
„ Material		14,400	By Abnormal loss	40	2,800
„ Labour		33,400	„ Completed and transferred to 'Y'	1,400	98,000
„ Overhead		16,700	„ Closing W.I.P.	460	20,700
	2,000	1,22,500		2,000	1,22,500

Equivalent Production—FIFO Method

***Problem 6.18.** SG Ltd. produces a product which passes through two processes namely CRA and REF. The particulars for May 1982 are as under :

	Units	Rs.	Rs.
(i) Stocks as on 1st May, 1982			
Raw materials			25,000
Work-in process—CRA	5,000		
Direct materials, 100% complete		62,500	
Direct labour, 50% complete		15,000	
Overheads, 50% complete		18,000	95,500
Work-in-process - REF	1,000		
Direct materials, 100% complete		1,00,000	
Direct labour, 25% complete		3,250	
Overheads, 25% complete		2,600	1,05,850
(ii) Costs and output for May, 1982			
Raw materials purchased			3,50,000
Raw materials issued to			
Process CRA	2,61,450		
Process REF	67,150		3,28,600

Other costs of Process CRA :		
Direct labour	1,16,250	
Overheads	1,32,690	2,48,940
<hr/>		
Other costs of Process REF :		
Direct labour	76,750	
Overheads	61,114	1,37,864
<hr/>		
(iii) Finished output of process CRA transferred to Process REF	20,000	
Finished output of Process REF transferred to stock of finished goods	20,200	
<hr/>		
(iv) On 31st May, 1982, the stocks of work-in-process are :		
Process CRA	4,000	
Degree of completion :		
Raw material 100%		
Labour and overheads 25%		
Process REF	800	
Degree of completion :		
Raw materials 100%		
Labour and overheads 50%.		

You are required to prepare statements showing the following for both the processes :

- Cost per unit of equivalent production ;
- Value of closing stock as on 31st May, 1982 ;
- Process cost accounts. (ICWA Final, June 1982)

Solution.**Process Cost Sheet**
(FIFO Method)

Period—May 1982

Process—CRA
Opening W.I.P. 5,000 units
Units introduced 19,000.**Statement of Equivalent Production**

Input		Output Items	Units	Equivalent Production			
				Material		Labour	
Items	Units			Units	%	Units	%
Opening W.I.P.	5,000	(i) Units completed					
		(a) Opening WIP	5,000	—	—	2,500	50%
		(b) Newly introduced transfer-					
		red to process					
		REF	15,000	15,000	100%	15,000	100%
		(ii) Closing W.I.P.					
			20,000			1,000	25%
			4,000	4,000	100%	—	—
			24,000	19,000		18,500	
						1,000	25%
						18,500	

Note : It is presumed that SG Ltd. follows FIFO method.

Statement of Cost for Each Element

<i>Elements of Cost</i>	<i>Cost</i>	<i>Equivalent Production</i>	<i>Cost per unit</i>
	Rs.	Units	Rs.
Material	2,61,450	19,000	13·761
Labour	1,16,250	18,500	6·284
Overhead	1,32,690	18,500	7·172
	<u>5,10,390</u>		

Statement of Apportionment of Cost

<i>Items</i>	<i>Elements of cost</i>	<i>Equivalent Production</i>	<i>Cost per unit</i>	<i>Cost</i>	<i>Total cost</i>
		Units	Rs.	Rs.	Rs.
Opening work-in-process (for completion)	Material	—	13·761	—	
	Labour	2,500	6·284	15,710	
	Overhead	2,500	7·172	17,930	33,640
Introduced and completed during the month	Material	15,000	13·761	2,06,410	
	Labour	15,000	6·284	94,260	
	Overhead	15,000	7·172	1,07,580	4,08,250
Closing W.I.P.	Material	4,000	13·761	55,044	
	Labour	1,000	6·284	6,284	
	Overhead	1,000	7·172	7,172	68,500
					<u>5,10,390</u>

Process CRA A/c

	<i>Units</i>	<i>Amount</i>		<i>Units</i>	<i>Amount</i>
					Rs.
To Opening stock	5,000	Rs. 95,500	By Process REF A/c	20,000	5,37,390
„ Material	19,000	2,61,450	„ Closing stock A/c	4,000	68,500
„ Labour		1,16,250			
„ Overhead		1,32,690			
	<u>24,000</u>	<u>6,05,890</u>		<u>24,000</u>	<u>6,05,890</u>

Cost of units transferred to REF A/c

- (i) Cost already incurred on units in opening stock **Rs. 95,500**
- (ii) Cost incurred to bring opening work-in-process to completion stage **33,640**
- (iii) Cost of units introduced and completed during the period **4,08,250**
- 5,37,390**

Statement of Cost for Each Element

<i>Element of cost</i>	<i>Cost</i>	<i>Equivalent production</i>	<i>Cost per unit</i>
	Rs.	Units	Rs.
Materials from process CRA	5,37,390		
Material introduced in Process REF	67,150		
Total material	6,04,540	20,000	30.227
Direct labour	76,750	20,350	3.7715
Overhead	61,114	20,350	3.0031
	7,42,404		

Statement of Apportionment of Cost

<i>Items</i>	<i>Elements of cost</i>	<i>Equivalent production</i>	<i>Cost per unit</i>	<i>Cost</i>	<i>Total cost</i>
		Unit	Rs.	Rs.	Rs.
Opening work-in-process	Material	—	—	—	—
	Labour	750	3.7715	2,829	
	Overhead	750	3.0031	2,253	
					5,082
Units introduced and completed	Materials	19,200	30.227	5,80,358	
	Labour	19,200	3.7715	72,413	
	Overhead	19,200	3.0031	57,659	
					7,10,430
Closing stock	Material	800	30.227	24,182	
	Labour	400	3.7715	1,509	
	Overhead	400	3.0031	1,201	
					26,892

Process REF Account

To Opening W.I.P.	1,000	1,05,850	By Finished stock A/c	20,200	8,21,362
To CRA A/c	20,000	5,37,390	By Closing stock	800	26,892
To Material		67,150			
To Labour		76,750			
To Overhead		61,114			
	<u>21,000</u>	<u>8,48,254</u>		<u>21,000</u>	<u>8,48,254</u>

Cost of Units transferred to Finished Stock Account :

(i) Cost already incurred on opening work-in-process	Rs. 1,05,850
(ii) Cost incurred to bring opening work-in-process to completion stage	5,082
(iii) Cost of units introduced and completed during the period	7,10,430
	8,21,362

FIFO Method—Cost of opening stock not given

***Problem 6 19.** Wve Chemicals p.l.c. manufactures a range of products in a variety of processes and the data given below relate to Process 3 for the month of April.

You are required to prepare :

- (a) a statement showing the cost per unit and the value of the output ;
- (b) an account for Process 3 ;
- (c) an Abnormal Gain or Loss account.

Transfer from Process 2	10,800 units	Rs. 7,980
Transfer to Process 4	9,650 units	
Direct materials added during process		2,019
Direct wages incurred in process		2,889
Production overhead apportioned to process		6,482

There is a normal loss in process of 10% of the output. All units scrapped can be sold at Re. 0·20 each.

Opening work-in-progress :	1,200 units	
Degree of completion :	materials added in process	40%
	direct wages	60%
	production overhead	70%
Closing work-in-progress :	1,000 units	
Degree of completion :	materials added in process	80%
	direct wages	60%
	production overhead	40%
Units scrapped :	1,350 units	
Degree of completion :	materials added in process	50%
	direct wages	40%
	production overhead	20%

(I.C.M.A. London, May 1984—Adapted)

Solution.**Process 3**

Period April

Statement of Equivalent Production
(a) (FIFO Method)

Input		Output	Equivalent Production						
Particulars	Units	Particulars	Units	Material 1		Material 2		Labour	Overhead
				(Input from process 2)	%	Added in the Process	%		
			Units	Units	%	Units	%	Units	%
Op. Stock	1,200	Normal loss	1,100	—	—	—	—	—	—
		Abnormal loss	250	250	100	125	50	100	40
Units Introduced	10,800	Units completed							
		(a) Work on op. stock	1,200	—	—	720	60	480	40
		(b) Fresh units	8,450	8,450	100	8,450	100	8,450	100
		Closing Stock	1,000	1,000	100	800	80	600	40
			12,000	9,700		10,095		9,630	

Statement of Cost for each element

<i>Element of Cost</i>	<i>Cost</i>	<i>Equivalent Production</i>	<i>Cost per Unit</i>
Cost of Units introduced	Rs. 7,980	Rs.	Rs.
Less : Scrap (1,100 × Rs. 0.20)	220		
	7,760	9,700	0.8
Direct material	2,019	10,095	0.2
Wages	2,889	9,630	0.3
Production overhead	6,482	9,260	0.7
			2.0

Statement of Apportionment of Cost

<i>Items</i>	<i>Elements</i>	<i>Equivalent Production</i>	<i>Cost per unit</i>	<i>Cost</i>	<i>Total Cost</i>
1. Cost incurred for completing opening stock	Material transferred	—	0.8	—	—
	Material (introduced)	720	0.2	144	
	Labour	480	0.3	144	
	Overhead	360	0.7	252	540
2. Abnormal loss	Material I	250	0.8	200	
	Material II	125	0.2	25	
	Labour	100	0.3	30	
	Overhead	50	0.7	35	290
3. Fresh Units Introduced and completed	Material I	8,450	0.8	6,760	
	Material II	8,450	0.2	1,690	
	Labour	8,450	0.3	2,535	
	Overhead	8,450	0.7	5,915	16,900
4. Closing stock	Material I	1,000	0.8	800	
	Material II	800	0.2	160	
	Labour	600	0.3	180	
	Overhead	400	0.7	280	1,420
					19,150

(b) Process 3 A/c

	Units	Rs.		Units	Rs.
To Opening stock	1,200	*	By Normal loss	1,100	220
„ Unit transferred from Process 2	10,800	7,980	„ @ Rs. 0.20		
„ Direct material		2,019	„ Abnormal loss	250	290
„ Labour		2,889	„ Units completed	9,650	17,440*
„ Production overhead		6,482	„ Closing stock	1,000	1,420
	<u>12,000</u>	<u>19,370</u>		<u>12,000</u>	<u>19,370</u>

(c) Abnormal loss A/c

	Units	Rs.		Units	Rs.
To Process 3 A/c	250	290	By Scrap	250	50
			„ Profit and Loss Account		240
	<u>250</u>	<u>290</u>		<u>250</u>	<u>290</u>

*1. The cost of opening stock is not given. The cost incurred on opening stock earlier will be added in both the columns.

2. Rs. 17,440 = Rs. 540 + Rs. 16,900, i.e., cost incurred on completing opening stock and cost incurred for completing fresh units.

3. There can be another approach to the situation in which cost incurred on opening stock is not given. It can be supposed that cost per unit in March also was Rs. 2.00.

Cost of 1,200 units @ Rs. 2	Rs. 2,400
Less : Cost incurred in Process 3	Rs. 540

Cost presumed to have been incurred in process	1,860
------------------------------------------------	-------

If this presumption is taken process account will appear as follows.

Process 3 A/c

	Units	Rs.		Units	Rs.
To Opening stock	1,200	1,860	By Normal loss	1,100	220
„ Units transferred from Process 2	10,800	7,980	„ @ Rs. 0.20		
„ D. Material		2,019	„ Abnormal loss	250	290
„ Labour		2,889	„ Units completed	9,650	19,300*
„ Prod. OH.		6,482	„ Cl. stock	1,000	1,420
	<u>12,000</u>	<u>21,230</u>		<u>12,000</u>	<u>21,230</u>

*Rs. 1,860 + Rs. 540 + Rs. 16,900 = Rs. 19,300.

Process Account—Average Method

Problem 6-20. A manufacturing company makes a product by two processes and the data below relate to the second process for the month of April.

A work-in-progress balance of 1,200 units brought forward from March was valued at cost, as follows :

Direct Materials, complete	Rs. 10,800
Direct wages, 60% complete	6,840
Production overhead, 60% complete	7,200

During April, 4,000 units were transferred from the first process to the second process at a cost of Rs. 7.50 each, this input being treated as direct material within the second process.

Other costs incurred by the second process were :

Additional direct materials	Rs. 4,830
Direct wages	32,965
Production overhead	35,538

3,200 completed units were transferred to finished goods stock. A loss of 520 units, being normal, occurred during the process. The average method of pricing is used.

Work-in-progress at the end of April consisted of 500 completed units awaiting transfer to the finished goods stock and a balance of unfinished units, which were complete as regards direct material and 50% complete as regards direct wages and production overhead.

You are required to :

- (a) prepare for the month of April the account for the second process.
- (b) present a statement for management setting out the :
 - (i) Cost per unit of the finished product, by element of cost and total
 - (ii) Cost of production transferred to finished goods.
 - (iii) Cost of production of completed units awaiting transfer to finished goods.
 - (iv) Cost of uncompleted units in closing work-in-progress by element of cost and in total.

(I.C.M.A. London, May Adapted 1985)

Solution. (a) Second Process A/c

Particulars	Units	Per unit	Amount	Particulars	Units	Per unit	Amount
To Opening Stock	1,200			By Normal loss	520		—
Direct Material			10,800	„ Units transferred to Finished Goods A/c	3,200	29.45	94,240
Direct wages			6,840	„ Units awaiting transfer to Finished Goods	500	29.45	14,725
Production Overhead	4,000		7,200	„ Work in Progress A/c	980		19,208
First Process A/c			30,000				
Direct Material			4,830				
Wages			32,965				
Production Overhead			35,538				
			1,28,173				1,28,173

(b) Necessary Calculation

Statement of Equivalent Production

Particulars	Input Units	Output		Equivalent Material		Production Labour		Overhead	
		Particulars	Units	Units	%	Units	%	Units	%
Opening Stock	1,200	Normal loss	520	—	—	—	—	—	—
New Units Introduced	4,000	Transferred to F/G A/c	3,200	3,200	100	3,200	100	3,200	100
		Completed awaiting transfer	500	500	100	500	100	500	100
		Work-in-progress	980	980	100	490	50	490	50
	5,200		5,200	4,680		4,190		4,190	

(b) (i) **Statement of cost per unit for each element**

<i>Elements of cost</i>	<i>Cost of Opening WIP</i>	<i>Cost in Process</i>	<i>Total Cost</i>	<i>Equivalent Production (units)</i>	<i>Cost per unit</i>
	Rs.	Rs.	Rs.		Rs.
Direct Material	10,800	30,000	45,630	4,680	9.75
		4,830			
Direct Wages	6,840	32,965	39,805	4,190	9.50
Production Overhead	7,200	35,538	42,738	4,190	10.20

(ii) **Cost of Finished Products**

<i>Elements</i>	<i>Equivalent Production (units)</i>	<i>Cost per unit</i>	<i>Cost</i>	<i>Total</i>
D. Material	3,200	Rs. 9.75	Rs. 31,200	Rs.
D. Wages	3,200	9.50	30,400	
Production Overhead	3,200	10.20	32,640	
				94,240

(iii) **Cost of production of completed units awaiting transfer to finished goods**

<i>Elements</i>	<i>Equivalent Production (units)</i>	<i>Cost per unit</i>	<i>Cost</i>	<i>Total</i>
		Rs.	Rs.	Rs.
D. Material	500	9.75	4,875	
D. Wages	500	9.50	4,750	
Production Overhead	500	10.20	5,100	
				14,725

(iv) **Cost of incomplete units in process**

<i>Elements</i>	<i>Equivalent Production (units)</i>	<i>Cost per unit</i>	<i>Cost</i>	<i>Total</i>
		Rs.	Rs.	
D. Material	980	9.75	9,555	
D. Wages	490	9.50	4,655	
Production Overhead	490	10.20	4,998	
				19,208

Equivalent Production (Average Method)

Problem 621. A company operates an expensive process plant to produce a single product from one process. At the beginning of October, 3,400 completed units were still in the processing plant, awaiting transfer to finished stock. They were valued as follows :

Direct material	Rs. 25,500
Direct wages	10,200
Production overhead	20,400 (200% of direct wages)

During October, 37,000 further units were put into process and the following costs charged to the process :

Direct materials	Rs. 2,76,340
Direct wages	1,12,000
Production overhead	2,24,000

36,000 units were transferred to finished stock and 3,200 units remained in work-in-progress at the end of October which were complete as to material and half-complete as to labour and production overhead. A loss of 1,200 units, being normal, occurred during the process

The average method of pricing is used : You are required to :

(a) prepare for the month of October, a statement (or statements) showing :

- production cost per unit in total and by element of cost ;
- the total cost of production transferred to finished stock ;
- the valuation of closing work-in-progress in total and by element of cost ;

(b) describe five of the characteristics which distinguish process costing from job costing. (C.I.M.A. London, Nov. 1988)

Solution : (a) Statement of Equivalent Production

Input Units	Particulars	Output Units	Equivalent Production	
			D. Material	D. Wage and P. Overhead
3,400	O Stock			
37,000	Introduced			
	Completed	36,000	36,000*	36,000*
	Normal loss	1,200	—	—
	C/Stock	3,200	3,200*	1,600**
40,400		40,400	39,200	37,600

*100% complete ;

**50% complete

Statement of Cost of each element

Element of Cost	Cost in Process (WIP & Introduced)	Equivalent Production	Cost per unit Rs.
Direct Material	Rs. 3,01,840	39,200	7.70

Direct Wages	1,22,200	37,600	3.25
Production Overhead	2,44,400	37,600	6.50
Total	6,68,440		17.45

Statement of Apportionment of Cost

Item	Element	Equivalent Production	Cost per unit Rs.	Cost Rs.	Total Cost Rs.
Units introduced and completed	D. Material	36,000	7.70	2,77,200	
	D. Wages	36,000	3.25	1,17,000	
	P. Overhead	36,000	6.50	2,34,000	6,28,200
Closing stock	D. Material	3,200	7.70	24,640	
	D. Wages	1,600	3.25	5,200	
	P. Overhead	1,600	6.50	10,400	40,240
					6,68,440

(b) Please refer to *Advanced Cost and Management Accounting—Text* by Saxena and Vashist.

INTER-PROCESS PROFITS

Problem 6.22. A Ltd produces product 'AXL' which passes through two processes before it is completed and transferred to finished stock. The following data relate to October 1981 :

Particulars	Process		Finished stock
	I	II	
Opening stock	Rs. 7,500	Rs. 9,000	Rs. 22,500
Direct materials	15,000	15,750	
Direct wages	11,250	11,250	
Factory overheads	10,500	4,500	
Closing stock	3,700	4,500	11,250
Inter-process profit included in opening stock		1,500	8,250

Output of process I is transferred to process II at 25% profit on the transfer price.

Output of process II is transferred to finished stock at 20% profit on the transfer price. Stocks in process are valued at prime cost. Finished stock is valued at the price at which it is received from process II. Sales during the period are Rs. 1,40,000.

Prepare process cost accounts and finished goods account showing the profit element at each stage. (C.A. Inter, Nov. 1981)

Solution :

Process I Account

	<i>Total</i>	<i>Cost</i>	<i>Profit</i>		<i>Total</i>	<i>Cost</i>	<i>Profit</i>
	Rs.	Rs.	Rs.		Rs.	Rs.	Rs.
Opening stock	7,500	7,500	-	Transfer to process II A/c			
Direct materials	15,000	15,000	—		54,000	40,500	13,500
Direct wages	11,200	11,200	—				
	33,700	33,700	-				
Less : Closing Stock	3,700	3,700					
Prime cost	30,000	30,000					
Overheads	10,500	10,500	-				
Process cost	40,500	40,500					
Profit $33\frac{1}{3}\%$ of total cost (See working note i)	13,500	—	13,500				
	54,000	40,500	13,500		54,000	40,500	13,500

Process II Account

	<i>Total</i>	<i>Cost</i>	<i>Profit</i>		<i>Total</i>	<i>Cost</i>	<i>Profit</i>
	Rs.	Rs.	Rs.		Rs.	Rs.	Rs.
Opening stock	9,000	7,500	1,500	Transferred to finished stock A/c			
Transfer from process I	54,000	40,500	13,500		1,12,500	75,750	36,750
Direct materials	15,750	15,750	-				
Direct wages	11,250	11,250	-				
	90,000	75,000	15,000				
Less : Closing Stock	4,500	3,750	750				

Process cost 90,000 75,750 14,250

Profit 25%

on total cost 22,500 — 22,500
(See working
note 2).

1,12,500 75,750 36,750

1,12,500 75,750 36,750

Finished Stock Account

	Total	Cost	Profit		Total	Cost	Profit
	Rs.	Rs.	Rs.		Rs.	Rs.	Rs.
Opening stock	22,500	14,250	8,250	Sales	1,40,000	82,500	57,500
Transfer from process II	1,12,500	75,750	36,750				
	1,35,000	90,000	45,000				

Less : Closing
stock 11,250 7,500 3,750

Cost of Fini-
shed stock 1,23,750 82,500 41,250
Profit 16,250 — 16,250

1,40,000 82,500 57,500

1,40,000 82,500 57,500

Working Notes :

Let the transfer price be 100 then profit is 25, i.e., cost price is 75

1. If cost is Rs. 75 then profit is Rs. 25

If cost is Rs. 40,500 then profit is $(25 \div 75) \times 40,500 = \text{Rs. } 13,500$.

2. If cost is Rs. 80 then profit is Rs. 20

If cost is Rs. 90,000 then profit is $(20 \div 80) \times 90,000 = \text{Rs. } 22,500$.

Problem 643. Product A passes through three processes, before it is transferred to finished stock. The following information is obtained for the month of July :

	Process I	Process II	Process III	Finished stock
	Rs.	Rs.	Rs.	Rs.
Opening stock	5,000	8,000	10,000	20,000
Direct material	40,000	12,000	15,000	—
Direct wages	35,000	40,000	35,000	—

Manufacturing overhead	20,000	24,000	20,000	—
Closing stock	10,000	4,000	15,000	30,000
Profit % on transfer price to next process	25%	20%	10%	
Inter-process profit for opening stock	—	1,395	2,690	6,534

Stock in process is valued at prime cost and finished stock has been valued at the price at which it is received from process III. Sales during the period were Rs. 4,00,000.

Prepare and compute :

- Process cost accounts showing profit element at each stage.
- Actual realised profit.
- Stock valuation for B/S purpose. (C.A. Final, Nov. 1982)

Solution,

(a) The process cost accounts for process I, process II and process III and finished stock account showing profit element at each stage of production are as follows :

Process I Account

	Total	Cost	Profit		Total	Cost	Profit
To Opening stock	Rs. 5,000	Rs. 5,000	Rs. —	By Process II A/c	Rs. 1,20,000	Rs. 90,000	Rs. 30,000
To Direct material	40,000	40,000	—				
To Direct wages	35,000	35,000	—				
Total	80,000	80,000	—				
Less : Closing Stock	10,000	10,000	—				
Prime cost	70,000	70,000	—				
To Mfg. overhead	20,000	20,000	—				
	90,000	90,000	—				
To Gross profit 25% on transfer price or 33 1/3% on cost	30,000	—	30,000				
	1,20,000	90,000	30,000		1,20,000	90,000	30,000
To Stock b/d	10,000	10,000	—				

Process II Account

	<i>Total</i>	<i>Cost</i>	<i>Profit</i>		<i>Total</i>	<i>Cost</i>	<i>Profit</i>
	Rs.	Rs.	Rs.		Rs.	Rs.	Rs.
To Opening stock b/f	8,000	6,605	1,395	By Process III A/c	2,50,000	1,69,303	80,697
To Process I A/c	1,20,000	90,000	30,000				
To Direct material	12,000	12,000	—				
To Wages	40,000	40,000	—				
Total	1,80,000	1,48,605	31,395				
Less : Closing stock	4,000	3,302	698				
Prime cost	1,76,000	1,45,303	30,697				
To Mfg. overhead	24,000	24,000	—				
	2,00,000	1,69,303	30,697				
To Gross profit 20% on transfer price or 25% of cost	50,000	—	50,000				
	2,50,000	1,69,303	80,697		2,50,000	1,69,303	80,697
To Balance b/d	4,000	3,302	698				

Process III Account

	<i>Total</i>	<i>Cost</i>	<i>Profit</i>		<i>Total</i>	<i>Cost</i>	<i>Profit</i>
	Rs.	Rs.	Rs.		Rs.	Rs.	Rs.
To Opening stock b/d	10,000	7,310	2,690	By Finished stock A/c	3,50,000	2,35,648	1,14,352
To Process II A/c	2,50,000	1,69,303	80,697				
To Direct material	15,000	15,000	—				

To Direct wages 35,000 35,000 —

3,10,000 2,26,613 83,387

Less : Closing stock b/d

15,000 10,965 4,035

2,95,000 2,15,648 79,352

To Mfg. overhead

20,000 20,000 —

3,15,000 2,35,648 79,352

To Gross profit 10% on transfer price or 1/9th of cost

35,000 — 35,000

3,50,000 2,35,648 1,14,352

3,50,000 2,35,648 1,14,352

To Closing stock b/d

15,000 10,965 4,035

Finished Stock Account

	Total Rs.	Cost Rs.	Profit Rs.		Total Rs.	Cost Rs.	Profit Rs.
To Opening stock b/f	20,000	13,466	6,534	By Sales	4,00,000	2,28,916	1,71,084
To Process III A/c	3,50,000	2,35,648	1,14,352				
	3,70,000	2,49,114	1,20,886				
Less : Closing stock	30,000	20,198	9,802				
	3,40,000	2,28,916	1,11,084				
To Gross profit	60,000	—	60,000				
	4,00,000	2,28,916	1,71,084		4,00,000	2,28,916	1,71,084
To Closing stock	30,000	20,198	9,802				

Working Notes :

Calculation of cost of closing stock and unrealised profit included therein.

Process II :

$$\begin{aligned}\text{Cost of closing stock} &= \frac{\text{Cost}}{\text{Total}} \times \text{Closing stock} \\ &= \frac{1,48,605}{1,80,000} \times 4,000 \quad \text{or Rs. 3,302} \\ \text{Unrealised profit} &= \text{Total cost} - \text{Cost} \\ &= \text{Rs. 4,000} - \text{Rs. 3,302} \quad \text{or Rs. 698}\end{aligned}$$

Process III :

$$\begin{aligned}\text{Cost of closing stock} &= \frac{\text{Cost}}{\text{Total}} \times \text{Closing stock} \\ &= \frac{2,26,613}{3,10,000} \times 15,000 \quad \text{or Rs. 10,965} \\ \text{Unrealised profit} &= \text{Total} - \text{Cost} \\ &= \text{Rs. 15,000} - \text{Rs. 10,965} \quad \text{or Rs. 4,035}\end{aligned}$$

Finished stock :

$$\begin{aligned}\text{Cost of closing stock} &= \frac{\text{Cost}}{\text{Total}} \times \text{Closing stock} \\ &= \frac{2,49,114}{3,70,000} \times 30,000 \quad \text{or Rs. 20,198} \\ \text{Unearned profit} &= \text{Total cost} - \text{Cost} \\ &= 30,000 - 20,198 \quad \text{or Rs. 9,802}\end{aligned}$$

(a) Computation of actual profit realised :

		Apparent profit	Unrealised profit			Actual profit
			Opening stock	Closing stock	Difference	
Process I	Rs. 30,000	Rs. —	Rs. —	Rs. —	Rs. —	30,000
Process II	50,000	1,395	698	(+) 697		50,697
Process III	35,000	2,690	4,035	(-) 1,345		33,655
Finished stock	60,000	6,534	2,802	(-) 3,268		56,732
Total	1,75,000	10,619	14,535	(-) 3,916		1,71,084
	=====	=====	=====	=====		=====

(b) Stock valuation for B/S :

Process I	Rs. 10,000
Process II	3,302
Process III	10,965
Finished stock	20,198
Total	44,465

<i>Alternatively :</i>		Rs.
Cost incurred in process I		[40,000
		35,000
		20,000
Cost incurred in process II		[12,000
		40,000
		24,000
Cost incurred in process III		[15,000
		35,000
		20,000
Total cost incurred in three processes		7,41,000
<i>Add :</i> Cost of opening stock	Rs.	
Process I	5,000	
Process II (Cost only)	6,605	
Process III (Cost only)	7,310	
Finished stock	13,466	32,381

		2,73,381
<i>Less :</i> Cost of goods sold		2,28,916

Cost of closing stock		44,465

Authors' Special Notes

1. Problem 6'4 exposes the reader to all aspects of problem of equivalent production, normal and abnormal gain.

2. Note the difference between treatment of FIFO method and average method by referring to Problems 6'19 and 6'20.

BREAK-UP OF PROBLEMS RELATING TO PROCESS COSTING ACCORDING TO DIFFERENT LEVELS (FOR PROBLEMS WITH PREFIX A, REFER TO APPENDIX A)

Intermediate Level

Normal and Abnormal Loss—P 6-1, 6-2, 6-5, 6-7, 6-8, 6-10, 6-11, 6-12
A 91, A 118, A 134

Equivalent Production—P 6-13, 6-14, 6-15, 6-16, 6-17, A 47, A 148, A 168

Inter Process Profit—P 6'22

Final Level

Normal and Abnormal Loss—P-6-3, 6-4, 6-6, 6-9

Equivalent Production—P 6'18, 6'19, 6'20, 6'21

Inter Process Profit—P 6'23.

Please also refer to the Examples 7-1 to 7-18 of the book "Advanced Cost and Management Accounting—Text" by Saxena and Vashist.

Operating Costing

[*Transport Costing—7·1—7·13 ; Power House Costing 7·14 ;
Hostel Costing 7·15—7·17 ; Hospital Costing 7·18*]

TRANSPORT COSTING

Fixing the bus charges for students

***Problem 7·1.** SMS is a public school having five buses each plying in different directions for the transport of its school students. In view of a large number of students availing of the bus service, the buses work two shifts daily both in the morning and in the afternoon. The buses are garaged in the school. The work-load of the students has been so arranged that in the morning the first trip picks up senior students and the second trip plying an hour later picks up the junior students. Similarly in the afternoon the first trip drops the junior students and an hour later the second trip takes the senior students home.

The distance travelled by each bus one way is 8 kms. The school works 25 days in a month and remains closed for vacation in May, June and December. Bus fee, however, is payable by the students for all the 12 months in a year.

The details of expenses for a year are as under :

Driver's salary	Rs. 450 per month per driver
Cleaner's salary	350 per month per cleaner

(Salary payable for all 12 months—

One cleaner employed for all the five buses)

Licence fee, taxes, etc.	860 per bus per annum
Insurance	1,000 per bus per annum
Repairs and maintenance	3,500 per bus per annum
Purchase price of the bus	1,50,000 each
Life	12 years
Scrap value	Rs. 30,000
Diesel cost	2·00 per litre

Each bus gives an average mileage of 4 km. per litre of diesel.

The seating capacity is fully occupied during the whole year.

Seating capacity of each bus—50 students.

Students picked up and dropped within a range up to 4 kms. of distance from the school are charged half fare and fifty per cent of the students travelling in each trip are in this category. Ignore interest. Since the charges are to be based on average cost, you are required to :

(i) Prepare a statement showing the expenses of operating a single bus and the fleet of five buses for a year ;

(ii) Work out the average cost per student per month in respect of :

(a) Students coming from a distance of up to 4 kms. from the school, and

(b) Students coming for a distance beyond 4 kms. from the school.

(C.A. Inter, May 1981)

Solution.**SMS Public School****Statement showing the Operating Cost of the Fleet**

<i>Particulars</i>	<i>Per bus per annum</i>	<i>Fleet of 5 buses per annum</i>
Driver's salary @ Rs. 450 p.m. per driver	Rs. 5,400	Rs. 27,000
Cleaner's salary @ Rs. 350 p.m. for one cleaner (one cleaner for 5 buses)	840	4,200
Licence fee, taxes, etc., @ Rs. 860 per bus p.a.	860	4,300
Insurance Rs. 1,000 per bus p.a.	1,000	5,000
Repairs and maintenance Rs. 3,500 per bus per annum	3,500	17,500
Depreciation (Rs. 1,50,000—Rs. 30,000)/12	10,000	50,000
Diesel cost (See note 1)	7,200	36,000
Total operating cost	28,800	1,44,000
(a) Operating cost per month	2,400	12,000
(b) Number of half-fare students	150	750
(c) Operating cost per half-fare student (a)÷(b)	Rs. 16'00	Rs. 16'00
(d) Operating cost per full-fare student (c)×2	32'00	32'00

Working Notes :**1. Calculation of diesel cost per bus**

Number of trips of 8 kms. each day=8 trips

Distance travelled per day by a bus : $8 \times 8 \text{ km./trip} = 64 \text{ kms.}$ Distance travelled during a month : $64 \times 25 = 1,600 \text{ kms.}$ Distance travelled p.a. : $1,600 \times 9 \text{ months} = 14,400 \text{ kms.}$

(May, June and December being vacations)

Mileage 4 kms. per litre

Diesel required : $14,400 \div 4 = 3,600 \text{ litres}$

Cost of diesel @ Rs. 2 per litre=Rs. 7,200 p.a. per bus.

2. Calculations of number of students per bus

Bus capacity	50 students
Half fare	50% i.e. 25 students
Full rate	50% i.e., 25 students
Full fare students as equivalent to half fare students, i.e.,	50 students
Total No. of half-fare students per trip	75 students
Total No. of half-fare students in 2 trips	150 students
On full-fare basis No. of students in 2 trips	75 students

Fixing operating charges for tank lorries

Problem 7.2. A chemical factory runs its boiler on furnace oil obtained from Indian Oil and Bharat Petroleum, whose depots are situated at a distance of 12 km. and 8 km. from the factory site. Transportation of furnace oil is made by the company's own tank lorries of 5 tonne capacity each. Onward trips are made only on full load and the lorries return empty. The filling-in time takes an average 40 minutes for Indian Oil and 30 minutes for Bharat Petroleum. But the emptying time for the factory is only 40 minutes for all. From the records available, it is found that the average speed of the company's lorries works out to 24 km. per hour. The varying operating charges average 60 paise per km. covered and fixed charges give an incidence of Rs. 7.50 per hour operation. Calculate the cost per tonne-mile from each source.

(C.A. Inter, May 1986)

Solution.

Operating Cost Statement

	Indian Oil	Bharat Petroleum
Distance (Depots to factory—full load)	12 km.	8 km.
Distance covered per trip	24	16
Running time @ 24 km. p.h.	60 minutes	40 minute
Filling-in time	40	30
Emptying time	40	40
Total time per trip	140	110
Details of Costs		
Variable operating charges @ 60 paise per km.		
Indian Oil (24 km. \times 0.60)	Rs. 14.40	
Bharat Petroleum (16 km. \times 0.60)		Rs. 9.60
Fixed Charges @ Rs. 7.50 per hour		
Indian Oil (140 \div 60 \times 7.50)	17.50	
Bharat Petroleum (110 \div 60 \times 7.50)		13.75
Total Cost per trip	Rs. 31.90	23.35
Tonne-kms. (full load)		
Indian Oil (5 tonne \times 12 kms.)	60	
Bharat Petroleum (5 tonnes \times 8 kms.)		40
Cost per tonne-km.	Re. 0.53	0.58

Computation of bus fare per passenger-km

Problem 7.3. Parkash Transport Company has been given a route 20 km. long to run a bus. The bus costs the company a sum of Rs. 50,000. It has been insured at 3% p.a. and the annual tax will amount to Rs. 1,000. Garage rent is Rs. 100 p.m. Annual repairs will be Rs. 1,000 and the bus is likely to last for 5 years.

The driver's salary will be Rs. 150 p.m. and the conductor's salary will be Rs. 100 p.m. in addition to 10% taking as commission (to be shared by the driver and the conductor equally).

Cost of stationery will be Rs. 50 p.m. Manager-cum-Accountant's salary is Rs. 350 p.m.

Petrol and oil will be Rs. 25 per 100 km. The bus will make 3 round trips carrying, on an average, 40 passengers on each trip. Assuming 15% profit on takings, calculate the bus fare to be charged from each passenger. The bus will run on an average 25 days in a month.

Solution. Statement showing the Fare to be charged for a Passenger Km.

	Passenger kms. Per annum	1,20,000* Per month
Standing charges :	Rs.	Rs.
Insurance	1,500	
Tax	1,000	
Garage rent	1,200	
Driver's salary	1,800	
Conductor's salary	1,200	
Stationery	600	
Manager-cum-Accountant's salary	4,200	
Standing charges per annum	11,500	
Standing charges per month		958.33
Variable charges :		
Depreciation $50,000 \div 5$	10,000	833.33
Repairs	1,000	83.34
Petrol and oil $25 \div 100 \times (20 \text{ km.} \times 2 \times 3 \times 25)$ $= 25 \div 100 \times 3,000$		750.00
Total cost without commission		2,625
Commission (as per workings below)		350
Profit (as per workings below)		525
Total takings		3,500
Fare per passenger km.		0.029
	or say Re.	0.03

Workings :

The driver and conductor are entitled to a commission @ 10% of the 'takings'. Let us suppose that the :

$$\begin{aligned} \text{Takings} &= x \\ \text{Commission @ 10\%} &= x \times \frac{10}{100} \quad \text{or} \quad \frac{x}{10} \\ \text{Profit to be charged 15\% on takings} &= x \times \frac{15}{100} \quad \text{or} \quad \frac{3x}{20} \end{aligned}$$

Total cost per month without commission = Rs. 2,625

∴ Takings = Total cost without commission + commission to driver and conductor + profit

$$x = \text{Rs. } 2,625 + \frac{x}{10} + \frac{3x}{20}$$

$$20x = 52,500 + 2x + 3x$$

$$15x = 52,500 \quad \text{or} \quad x = \text{Rs. } 3,500$$

Taking Rs. 3,500

Commission @ 10% of takings = Rs. 350

Profit @ 15% of takings = Rs. 525

* Passenger kms. have been worked out as under :

Total effective passenger kms. per month

$$= 20 \text{ km.} \times 2 \text{ (return trip)} \times 3 \text{ trips} \times 25 \text{ days} \times 40 \text{ passengers}$$

$$= 1,20,000 \text{ passenger kms. per month.}$$

Reimbursement for using own car

Problem 7.4. Mr. Harry is a Travelling Inspector for the Environmental Protection Agency. He uses his own car and the agency reimburses him at Rs. 1.80 per kilometre. Mr. Harry claims he needs Rs. 2.20 per kilometre just to break-even. A scrutiny of his expenses by the agency reveals the following :

Oil change every 4,800 kms.	Rs. 120
Maintenance (other than oil) every 9,600 kms.	1,800
Yearly insurance (comprehensive with accident benefits)	4,000
Cost of car, with an average residual value of Rs. 60,000 and with a useful life of 3 years	1,08,000

Petrol is Rs. 5 a litre and Harry gets 8 kms. per litre in his car. When Harry is on the road, he averages 192 kilometres a day. He works 5 days a week, has 10 days vacation in a year besides 6 holidays and spends 15 working days a month, in the office.

You are required to determine :

(a) an equitable rate of reimbursement on the basis of the schedule he presently follows and (b) the number of kilometres a year he would have to travel, to break-even at the current rate of reimbursement.

(I.C.W.A. Inter, Dec., 1982)

Solution.**(a) Total kilometres covered by Mr. Harry in one year**

Total number of days in one year		365
Less : Vacation	10	
Holidays	6	
Week-ends (52 weeks \times 2 days)	104	
Days spent in office (12 months \times 15 days)	180	300
		<hr/>
Actual days of travelling in a year		65
Average kilometres in one day = 192		
Total kilometres in 65 days = 192×65		
Total distance covered = 12,480 kms.		

Cost Incurred for Travelling 12,480 kms.

Oil change ($120 \div 4,800 \times 12,480$)	Rs.	312
Maintenance ($1,800 \div 9600 \times 12,480$)		2,340
Yearly insurance		4,000
Depreciation ($(1,08,000 - 60,000)/3$)		16,000
Cost of petrol ($12,480 \div 8 \times \text{Rs. } 5$)		7,800
		<hr/>
Total cost to break-even		30,452
		<hr/>
Cost per km. to break-even ($30,452 \div 12,480$)		2.44 per km.
		<hr/>

(b) Number of kms. required to be travelled in a year to Break-even at Rs. 1.80 per km.

Fixed cost :	Rs.
Yearly insurance	4,000
Depreciation	16,000
	<hr/>
Total fixed cost	20,000
	<hr/>

Variable Cost for Covering 9600 kms.

Maintenance	Rs.	1,800
Oil change ($120 \div 4,800 \times 9,600$)		240
Cost of petrol ($9,600 \div 8 \times \text{Rs. } 5$)		6,000
		<hr/>
		8,040
		<hr/>

Variable cost per km. = $8,040 \div 9600$ or Re. 0.8375

Contribution per km. = Rs. 1.80 - 0.8375 = Re. 0.9625.

No. of kms. required to break even = $\frac{\text{Rs. } 20,000}{\text{Rs. } 0.9625} = 20,779 \text{ km.}$

In order to get a contribution of Rs. 20,000, Harry has to travel 20,779 kilometres.

Transport Costing (Miscellaneous problem)

Problem 7.5. Indicate the fallacy in the undermentioned cases :

(i) In a hospital, the number of patients in a year totalled 10,000. The cost of running the hospital was Rs. 50,00,000. The accountant proposes to charge Rs. 500 from each patient.

(ii) A truck operator spends on the average Rs. 20,000 in a month; he carries 1,000 tonnes in a month, the distance involved being different from customer to customer. The accountant proposes to charge Rs. 25 (Rs. 5 to cover profit) per tonne.

(iii) A power house consumes 30,000 tonnes of coal every month @ Rs. 500 per tonne. Coal ash of 1500 tonnes is produced every month. The accountant says the cost of coal used is 28,500 tonnes @ Rs. 500 or Rs. 1,42,50,000.

(iv) In a motor repair works, the cost for a job is worked out by adding the cost of parts used and the wages paid to the worker involved. (C.S. Inter, June 1987)

Solution. (i) The cost unit proposed is wrong. The total number of patient-days should be calculated. For different operations there should be different charge. The approach of accountant is wrong.

(ii) Cost per tonne-km should be worked out and charge should be made accordingly based on tonne-km.

(iii) The sale value of coal ash should be deducted from the cost of coal. The statement of accountant is wrong.

(iv) The charge should include :

(i) Cost of parts.

(ii) Charge for time spent by worker based on his wages.

(iii) A share of fixed overhead like rent of workshop, salary of supervisor. This charge can be made as a percentage of charge for worker's time.

Own Car vs. Hiring

Problem 7.6. The transport department of a very large company maintains a fleet of 60 cars for use by authorised company personnel.

The department budget allows 10 paise per mile of operation plus Rs. 75,000 per year for general maintenance.

During last year, 60 cars were operated on an average of 60,000 miles each. Total cost in the transport department was Rs. 4,75,000. The hiring cost of similar cars would be 15 paise per mile.

You are required to evaluate the operation of the transport department if it is regarded (i) as a cost centre and (ii) as a profit centre.

Would it have been more profitable for the company to have its own cars last year than to hire them?

At what volume of operation, would it be more profitable to hire cars?
(CA. Final, Nov. 1984)

Solution. Company should have its own car at a volume where saving in variable cost exceeds the fixed cost.

(i) Evaluation of the operations of the Transport Department, if it is a cost centre.

Budgeted Cost

Variable—

60 cars × 60,000 miles @ Re. 0·10

Rs. 3,60,000

Fixed

75,000

Budgeted Cost

4,35,000

Actual Costs

4,75,000

Unfavourable Expenditure Variance

40,000

(ii) Evaluation of the operation of the Transport Department, if it is a profit centre.

Deptt. revenue :

60 cars × 60,000 @ Re. 0·15

Rs. 5,40,000

Department Costs

4,75,000

Favourable Divisional Profit Variance

65,000

It is clear from above that it would have been more profitable for the company to have its own car than to hire them.

(iii). *Break-even point.*

Saving in Variable Cost by having own car = $0·15 - 0·10$ or $= 0·05$

Break-even point = $75,000 \div 0·05 = 15,00,000$ lakh mile per annum.

∴ If annual volume of operation is below 15 lakh miles, it would be in the interest of company to hire.

Operating Cost statement

Problem 77. There are two warehouses for storing finished goods in a factory. Warehouse A is at a distance of 10 km. and warehouse B at a distance of 15 km. from the factory. A fleet of 5-tonne lorries is engaged in transporting the finished goods from the factory. The records show that the lorries average a speed of 30 kms. per hour when running and regularly takes 40 minutes to load at the factory. At warehouse 'A', unloading takes 30 minutes per load while at warehouse 'B', it takes 20 minutes per load.

Drivers wages, depreciation, insurance and taxes amount to Rs. 18 per hour operated. Fuel, oil, tyres and maintenance cost Rs. 2·40 per kilometre. You are required to draw up a statement showing the cost per tonne-kilometre for carrying the finished goods to the two warehouses.

(I.C.W.A. Inter, Dec. 1984)

Solution : For preparing an operating cost statement, it is first necessary to arrive at the operating time required for both the warehouses.

Operating Time

	Warehouse 'A' (Minutes)		Warehouse 'B' (Minutes)
For covering 10 km. @ 30 kms. per hour	20	For covering 15 km.	30
For return journey	20	For return journey	30
Loading time	40	Loading time	40
Unloading time	30	Unloading time	20
	---		---
Total operating time (minutes)	110	Total operating time	120
	or 1 hours 50 minutes		or 2 hours

Statement showing the operating cost per tonne-km

	Warehouse 'A'		Warehouse 'B'
Tonne-km (5 tonne × 10 km)	50	Tonne-km. (5 tonne × 15 km.)	75
	---		---
Running charges per km	Rs. 2.40	Running charges per km.	Rs. 2.40
	---		---
Standing charges per hour	Rs. 18.00	Standing charges per hour	Rs. 18.00
	---		---

Operating Costs

(a) Running expenses		Running expenses	
20 kms. × Rs 2.40	Rs. 48	30 kms. × Rs. 2.40	Rs. 72
(b) Standing charges		Standing charges	
1 hr. 50 mts × Rs 18	33	(2 hour × Rs. 18)	36
	---		---
Total operating costs	81	Total operating costs	108
	---		---
Operating cost per		Operating cost per	
Tonne-km. Rs. 81 ÷ 50	Rs. 1.62	tonne km. Rs. 108 ÷ 75	Rs. 1.44

Hiring cars Vs. providing cars to executives

Problem 7.8. In view of increasing cost of operating own fleet of cars, your company is presently considering two proposals, viz.

- (i) To hire cars with drivers from an agency @ Rs. 800 per car per month. The company will bear the cost of petrol, oil and tyres.
- (ii) The executive will be given Rs. 25,000 interest free loan repayable in 5 years to buy his own car. The company will, however, provide him with free petrol and Rs. 500 per month for maintenance and driver's wages.

If the present cost of a car is Rs. 50,000 and monthly average running is 2,000 kilometres, find out the most economic way with the help of the following data :

	Paise per km.
Petrol	65
Oil	8
Tyre	7
Repair	10

Tax and Insurance Rs. 560 per year. Driver's wages and bonus Rs. 720 per month.

Life of a car 5 years

Resale value [at the end of 5th year Rs. 10,000.

Assume interest @ 18% per annum. (I.C.W.A. Final, June 1981)

Solution. Statement showing comparative cost of operation per car per month.

	Km. 2,000		
Items of cost	Company's own car	Hired Car	Executive car
Petrol	Rs. 1,300.00	Rs. 1,300.00	Rs. 1,300.00
Oil	160.00	160.00	—
Tyre	140.00	140.00	—
Repair	200.00	—	—
Taxes and Insurance	46.67	—	—
Wages and bonus	720.00	—	—
Depreciation (Rs. 50,000—Rs. 10,000) $\times \frac{1}{5}$	$\frac{1}{12}$ 666.67	—	—
Hire charges	—	800.00	—
Maintenance allowance	—	—	500.00
Interest on loan	—	—	375.00
Total Cost	3,233.34*	2,400.00	2,175.00
Cost per km.	Rs. 1.62	Rs. 1.20	Rs. 1.09

*This cost will still go up, because company would have earned interest, if it had invested Rs. 50,000 elsewhere. On the basis of above analysis, third alternative is recommended.

Fare structure of minibus—profit as a % of net sales

***Problem 7.9.** Carryall Enterprise has been permitted to run a minibus on a route covering 20 kms. The Minibus has been purchased at a cost of Rs. 1 lakh, part of which was financed through bank loan and balance by loan from other sources.

The annual charges for the Minibus are Insurance Rs. 4,000, Road Tax Rs. 2,000 and Garage Rent Rs. 1,200. Cost of repairs and maintenance is estimated at Rs. 6,000 per annum while replacement of tyre and tube will cost Rs. 480 per month. Office expenses are estimated at Rs. 600 per month. Petrol and oil will cost @ 45 Paise per km.

Two drivers and two conductors are engaged at a monthly salary of Rs. 500 and Rs. 350, respectively. In addition, drivers and conductors are entitled to 5% of the sale of tickets.

The effective life of the vehicle is estimated at 5 years, at the end of which the vehicle will have scrap value of Rs. 10,000. The Minibus is 24 seater and is expected to run 6 two-way trips during the day for 25 days in a month.

You are required to submit passenger fare structure for approval by the transport authority which allows 20% profit on net sales. Interest on loan is allowed as cost, if instalments are paid regularly, assume the amount of interest to be Rs. 6,720 p.a.

Solution. Statement showing calculation of fare structure of Minibus.

<i>A. Standing Charges</i>	<i>Cost per Annum</i>	<i>Cost per month</i>
Insurance	Rs. 4,000	
Road Tax	2,000	
Garage Rent	1,200	
Office Expenses (Rs. 600 p.m.)	7,200	
Depreciation (Refer to Note 1)	18,000	
Interest on loan	6,720	
Repair and Maintenance (Rs. 6,000 ÷ 12)	—	500
Drivers and conductors salary	—	1,700
	39,120	Rs. 5,460
<i>B. Operating Charges</i>		
Petrol and oil		2,700
(25 days × 6 × 2 trips × 20 km. × Re.0.45)		
Tyre and Tube		480
Commission (Refer to Note 2)		576
(5% on Sales)		
		<u>3,756</u>
<i>C. Total Cost (A+B)</i>		9,216
<i>D. Profit @ 20% on Sales (Refer to Note 2)</i>		<u>2,304</u>
<i>E. Sales of Tickets</i>		<u>11,520</u>

F. Total Kilometre (Refer to Note 3)	6,000
G. Total Passenger km (Refer to Note 4)	1,44,000
H. Rate per Passenger km ($E \div G$)	Rs. 0.08

Note 1.

Cost	Rs. 1,00,000
Less : Scrap Value	10,000
Net Cost	90,000
Estimated life	5 years
Depreciation per annum	Rs. 18,000

(As the estimated life of Minibus given in years and not in kilometres, it is taken as standing charge. The depreciation would have been operating cost, if the life of minibus has been expressed in kilometres.)

Note 2. (i) Suppose sales is x .

(ii) Total cost before commission = Rs. 8,640

(Rs. 3,260 + 2,700 + 480 + 500 + 1,700)

(iii) Commission is 5% of x or $x/20$.

(iv) Profit is 20% of x or $x/5$ or Total cost before commission + Commission + Profit = Sale

or Rs. 8,640 + $x/20$ + $x/5$ = x or Rs. 1,72,800 + x + $4x$ = $20x$
 or $15x$ = Rs. 1,72,800 or x = Rs. 11,520

\therefore Sales = Rs. 11,520

Commission = 5% of Rs. 11,520 or Rs. 576

Profit = 20% of Rs. 11,520 or Rs. 2,304.

Note 3. Total Distance = 25 days \times 6 \times 2 trips \times 20 km
 = 6,000 kms per month.

Note 4. Passenger km. = 6,000 km \times 24 seats or 1,44,000

Comparative Operating Statement of existing and replaced vehicles (one-side journey being empty)

Problem 7-10. A cement company employs 12 trucks of 5 tonnes capacity each for transport of limestone from the nearby quarry which is situated at a distance of 5 kilometres from the factory. The vehicles run empty on the outward journey and return with limestone. Each truck makes five trips to the quarry and back in a day. In an average month of 25 working days during a year, one day is lost by each truck on an average for repairs and maintenance. The other particulars are as under :

Fuel : 2.50 kilometres per litre of diesel at Rs. 2 per litre.

Purchase price for each truck : Rs. 72,000.

Life of each of the trucks : 12 years but all the trucks have completed 5 years of service.

Driver's salary : Rs. 800 per month each. One cleaner is employed for all the trucks at a salary of Rs. 500 per month.

Repairs and maintenance : Rs. 2,400 per annum per truck. Fixed expenses like taxes, tyres, batteries, etc. Rs. 6,000 per annum per truck.

The company proposes to replace these 12 trucks by 6 new trucks of 10 tonnes capacity each. The new trucks will also remain idle for one day a month for repairs and maintenance. The other particulars relating to the new trucks are :

Fuel : 2 kilometres per litre of diesel.

Repairs and maintenance : Rs. 2,400 per annum per truck.

Fixed expenses like taxes, tyres, batteries, etc. : Rs. 7,200 per annum per truck.

Purchase price : Rs. 1,40,000 each.

Life : 7 years.

The old trucks can be sold at 10% of the book value calculated on straight-line method of depreciation. The drivers rendered surplus in the change-over are proposed to be retrenched on payment of a compensation of Rs. 15,000 each immediately after the replacement proposal is put through. Interest is ignored.

Required :

(i) Prepare a comparative cost statement showing the operating cost per tonne of limestone in the existing situation and under the replacement proposed using straight line method of depreciation.

(ii) Advise your management on the economics of the replacement considering a capital recovery factor of 4.564 for discounting the future cash inflows at an expected return of 12% on capital employed.

[I.C.W.A., Final, Dec. 1982, C.A. Final, May 1982 (Modified)]

Suggested Approach

It is required to prepare a comparative cost statement showing the cost per tonne of limestone under the existing plan and under the proposed replacement plan. For this purpose, it is necessary first to find out total tonnage of limestone transported and total operating (standing cost as well as variable cost) under both the alternatives. It should be noted that unabsorbed depreciation of the existing trucks and cost of compensation of retrenched drivers consequent on purchase of 10 tonne capacity trucks will have to be added to the cost of proposed scheme.

Solution. (i) Comparative Quantitative Data

Particulars	Present Plan	Proposed Plan
Capacity of each truck (Tonne)	5	10
Number of Trucks	12	6
Number of days p.a. (24 days \times 12 months)	288	288

Number of trips in a day	5	5
Total tonnage of limestone transported p.a.		
Present ($5 \times 12 \times 288 \times 5$)	86,400	
Proposed ($10 \times 6 \times 288 \times 5$)		86,400
To and fro distance—quarry (kms)	10	10
Total distance p.a. (kms)		
Present ($12 \times 288 \times 5 \times 10$)	1,72,800	
Proposed ($6 \times 288 \times 5 \times 10$)		86,400
Mileage per litre of Diesel (kms)	2.5	2.0
Diesel required p.a. (Litres)		
Present ($1,72,800 \div 2.5$)	69,120	
Proposed ($86,400 \div 2$)		43,200
Total fuel cost p.a. @ Rs. 2 per litre	Rs. 1,38,240	86,400

..... Cement Company
Comparative Cost Statement for the year

<i>Particulars</i>	<i>Present</i>	<i>Proposed</i>
Tonnage	86,400	86,400
Fuel cost [as per working in (i) above] Rs.	1,38,240	Rs. 86,400
Drivers's salaries —Present ($800 \times 12 \times 12$)	1,15,200	
—Proposed ($800 \times 12 \times 6$)		57,600
Cleaner's salary (500×12)	6,000	6,000
Repairs and maintenance —Present (2400×12)	28,800	
—Proposed (2400×6)		14,400
Fixed expenses	72,000	43,200
Depreciation		
Present [$(72,000 \times 12) \div 12$]	72,000	
Proposed [$(1,40,000 \times 6) \div 7$]		1,20,000
Unabsorbed depreciation of existing trucks	—	64,800*
Compensation p.a. paid to retrenched drivers [(Rs. 15,000 \times 6) \div 7]	—	12,857
Total cost	4,32,240	4,05,257
Cost per tonne (approximately)	5.00	4.69

(ii) **Economics of the replacement proposal**

Expenditure p.a. before depreciation and imputed cost :	Rs.
Present proposal	3,60,240
Proposed proposal	2,07,600
	<hr/>
Savings per annum	1,52,640
	<hr/>
Capital recovery factor	4.564
Present value of future inflows, <i>i.e.</i> , savings per annum (Rs. 1,52,640 \times 4.564)	6,96,649
	<hr/>
Cash outflow : Rs. 1 40,000 \times 6	8,40,000
Compensation to the 6 retrenched drivers	90,000
	<hr/>
Total cash outflow	9,30,000
Less : Sales realisation from old trucks	50,400
	<hr/>
Net cash outflow	8,79,600
	<hr/>
*Calculation of un absorbed depreciation :	Rs.
Purchase price of 12 trucks @ Rs. 72,000 each	8,64,000
Less : Depreciation @ Rs. 72,000 p.a. for 5 years	3,60,000
	<hr/>
Present book value	5,04,000
Amount realised @ 10% of book value	50,400
	<hr/>
Unabsorbed depreciation	4,53,600
	<hr/>
Unabsorbed depreciation p.a. (4,53,600 \div 6)	64,800

It is noticed from the above computation that the present value of future cash inflows is less than the present value of the cash outflow. Apparently company is not able to get the desired rate of return on capital employed. Exact rate of return on capital employed under the two proposals cannot be worked out for want of number of months' requirement of working capital. Although the cost per tonne is less in the proposed plan, the new proposal cannot be accepted as it will not yield the desired rate of return. The management may, therefore, be advised to continue with the existing fleet of 12 trucks.

Choice of alternative modes of transport

***Problem. 7.11.** SV Ltd. has set up a treatment plant at Kaval town. The company purchases the basic raw material namely raw KAB and arranges for the sale of the finished product KAB after treatment in its plant.

The treatment plant has a capacity of 60,000 tonnes per annum of raw KAB. The variable costs of treatment of raw KAB are Rs. 4.00 per tonne and the fixed costs amount to Rs. 6,00,000 per annum. There is no loss in process.

The company owns a fleet of vehicles having a capacity to handle 260 lakhs tonne-kilometre of raw KAB. The fixed costs of the transport network of the company is Rs. 10,50,000 per annum and the variables costs amount to 8 paise per tonne-kilometre. The company can also provide another transport service to its customers for delivery of the finished product KAB. The cost of this service is estimated at 16 paise per tonne-kilometre variable and Rs. 45,000 per annum fixed. Facilities for hiring transport of incoming and outgoing goods are also available outside at a cost of 18 paise per tonne-kilometre.

The company has three sources of purchase of raw KAB as per details given below :

(i) The data relating to output, costs and distances of the three sources are :

	<i>Sources</i>		
	<i>Bee town</i>	<i>Cee town</i>	<i>Dee town</i>
Capacity of raw KAB (tonnes per annum)	9,000	27,000	45,000
Distance of the towns from Kaval town in kms.	250	250	500
Costs of extraction of raw KAB:			
Variable Costs (Rs./tonne)	90	120	68
Fixed Costs (Rs. per annum)	24,000	80,000	96,000

(ii) The source at Bee town being the subsidiary of the company has an offer from outside party for the purchase of its entire output of raw KAB at Rs. 108 per tonne from source.

(iii) Cee town has its own arrangement for the sale of its output of raw KAB but in proposed to offer the left over quantity of 8,000 tonnes per annum to the company at a cost of Rs. 120 per tonne.

(iv) The Dee town source can supply its entire quantity of raw KAB to the company.

The company can sell its treated product KAB to the following customers :

<i>Customers</i>	<i>Quantity of sales tonnes/annum</i>	<i>Price/tonne Rs.</i>	<i>Delivery terms</i>	<i>Distance from the company treatment Plant at Kaval km.</i>
NA	6,000	200	At customer's site	8
NB	6,000	188	Ex-factory Kaval	—
NC	15,000	168	Ex-factory Kaval	—
ND	9,000	150	Ex-factory Kaval	—
NE	10,000	192	At customer's site	22
NF	9,000	220	At customer's site	15
NG	9,000	200	At customer's site	26

You are required to :

(i) Evaluate the alternative proposal for the purchase of raw KAB sales of the treated product KAB and transportation plans for incoming and outgoing goods with a view to maximising the profitability.

(ii) Prepare a statement showing the profitability of the proposals recommended by you. *(I.C.W.A. Final, December 1984)*

Solution. (i) Choice of alternative modes of transport for inward movement of raw materials KAB.

Variable cost per tonne 1 km. (own transport)	Rs. 0.08
Fixed Cost ($10,50,000 \div 2,60,00,000$)	0.04
Total cost	0.12

This cost is less than other two proposals viz., (i) Variable Re. 0.16 per tonne/km. and Rs. 45,000 fixed and (ii) Rs. 0.18 per tonne/km. Therefore, company should accept internal transport which costs Re. 0.12 per tonne/km.

(ii) Statement showing the contribution per MT from different Sources

Details	Sources		
	Bee town	Cee town	Dee town
Distance (km.)	250	250	500
Variable cost/MT	Rs. 90	Rs. 120	Rs. 68
Treatment cost—Variable	4	4	4
Transport cost—Variable (Distance \times Variable cost of transport (Rs. 0.08))	20	20	40
Total Variable Cost	114	144	112
Minimum Selling Price	150	150	150
Contribution per MT	36	6	38
Ranking	2nd	3rd	1st

(iii) Availability of Raw Material Sourcewise

	Tonne: p.a
Dee town	Rs. 45,000
Bee town	9,000
Cee town	6,000 balance
Total availability (maximum capacity)	60,000

We know that the company is having a capacity to handle 260 lakh tonnes km. raw KAB. So the capacity based on above production would be as under :

Dee town	45,000 × 500 km. = 225.0 lakh tonne/km.
Beet own	9,000 × 250 „ = 22.5 „ „
Cee town	6,000 × 250 „ = 15.0 „ „

262.5 which is > 260

Hence 2,50,000 tonne/km. should be transported by hiring external transport. But total variable cost works out to Rs. 120 + Rs. 4 + 0.18 × 250 = Rs. 169 > Rs. 150, the minimum selling price. The demand from all types of customers is 64,000 tonnes per annum. Therefore, demand above this selling price (Rs. 150) is 64,000 - 9,000 = 55,000 tonnes per annum and hence external transport cannot be used. Accordingly production plan is reduced to the extent of 1,000 units of Cee town. The revised production plan will be :

Dee town	= 45,000 tonnes
Bee town	= 9,000 „
Cee town	= 5,000 „
	<hr/>
	59,000 „
	<hr/>

(iv) **Cost of Raw Material**

Qty.	<u>Variable Cost</u>		<u>Fixed Cost</u>
	Unit Variable cost	Total	
Dee town 45,000 Te.	Rs. 68	30,60,000	Rs. 96,000
Bee town 9,000	90	8,10,000	24,000
Cee town 5,000	120	6,00,000	—
		<hr/>	<hr/>
		44,70,000	1,20,000
		<hr/>	<hr/>

(v) **Cost of Inward Transport**

Variable	= 260,000 × 0.08 =	Rs. 20,80,000
Fixed	=	10,50,000
		<hr/>
		31,30,000
		<hr/>

(vi) **Cost of Processing**

Variable Cost (59,000 @ Rs. 4)	Rs. 2,36,000
Fixed Cost	6,00,000
	<hr/>
	8,36,000
	<hr/>

(vii) Sale to Various Customers

Customer	Sales Qty. (tonnes)	Price/tonne (Rs.)	Total Sales (Rs.)	Cost of outward transport
km. \times Rate \times Qty. = Cost				
NA	6,000	200	12,00,000	$8 \times 0.16 \times 6,000 = \text{Rs. } 7,680$
NB	6,000	188	11,28,000	—
NC	15,000	168	25,20,000	—
ND	4,000*	150	6,00,000	—
NL	10,000	192	19,20,000	$22 \times 0.16 \times 10,000 = 35,200$
NF	9,000	220	19,80,000	$15 \times 0.16 \times 9,000 = 21,600$
NG	9,000	200	18,00,000	$26 \times 0.16 \times 9,000 = 37,440$
			Total Variable Cost	1,01,920
			Fixed Cost	45,000
			1,11,48,000	Total Transport Cost 1,46,920

*Total sales from all customers

Budgeted production plan is restricted to

64,000 tonnes

59,000 "

Reduced sales

5,000 "

In cost of ND, price per tonne is the minimum. Therefore, 5,000 tonnes will be reduced from ND, i.e., 9,000 – 5,000 = 4,000 tonnes.

(viii) Profitability Statement

Sales realisation		Rs. 1,11,48,000
Less Expenses :		
Cost of raw materials	45,90,000	
Inward transport	31,30,000	
Processing cost	8,36,000	
Outward transport	1,46,920	87,02,920
Profit		24,45,080

Purchasing a car vs. contract hiring

Problem 7-12. A company has decided to supply a car for use by an engineer to visit various construction sites.

It is expected that the engineer will use the car for 10,000 miles a year on business trips. He will also be allowed to make private use of the car which is expected to amount to a further 10,000 miles a year.

It has been agreed that the company will pay all costs and expenses involved. The company use will be charged on mileage basis to the

contracts visited. The engineer will be charged for private usage at a rate based on the incremental expense incurred by the company beyond that required if business use only were involved.

The selected car is priced at Rs. 80,000 and will be replaced after two years. The trade-in price will be Rs. 40,000 for a mileage of 20,000 Rs. 30,000 for a mileage of 40,000. The car can also be obtained on contract hire for Rs. 28,000 a year for a two-year period, plus Re. 0.50 a mile for mileage over 30,000, the supplementary charge being calculated and paid at the end of the two-year period. All out-going cash for acquisition and trade-in credits will be payable or receivable on the first and last day respectively of the relative year. A bank will lend money for the acquisition or the contract hire expenses at a rate of 16% per annum. The loan will be assumed repaid at the end of the two-year period.

Cash to meet other payments will be advanced initially as required by the company without any interest charge. Later payments will be made from the notional income arising monthly as the contracts were charged with business mileage and the engineer for private usage. Any benefit arising from the use by the company of this accumulating income will be disregarded and assumed to offset the administrative costs.

Costs of operating the car are :

Annual charges—licence	Rs. 1,000
—insurance	3,200
—garage/parking	2,000

Repairs and maintenances

1st 10,000 miles	Rs. 1,800
2nd 10,000 miles	3,000
3rd 10,000 miles	4,000
4th 10,000 miles	5,300

Servicing

1st 10,000 miles	1,100
2nd 10,000 miles	1,300
3rd 10,000 miles	1,400
4th 10,000 miles	1,500

Tyres—each set has an estimated life of 30,000 miles and costs Rs. 2,000.

Petrol—average 32 miles per gallon at Rs. 20 a gallon

Oil—assume an average cost of Re. 0.025 a mile.

You are required to :

(a) decide from a financial view point whether the car should be purchased or obtained on contract hire ;

(b) calculate the average mileage rate applicable for :

(i) business use ;

(ii) Private use on the incremental basis stated, using the decision in (a) above.

[ICMA (London), November 1984 (Adapted)]

Solution. (a) Buy

	20,000 miles	40,000 miles
Cash	Rs. 80,000	Rs. 80,000
Less : Trade-in	40,000	30,000
	<hr/>	<hr/>
Loss in value	40,000	50,000
Interest on loan	—	—
Rs. $80,000 \times 16/100 \times 2$ years	25,600	25,600
	<hr/>	<hr/>
	65,600	75,600
	<hr/>	<hr/>

Contract Hire

Hire Cost ($2 \times \text{Rs. } 28,000$)	Rs. 56,000	Rs. 56,000
Interest :		
$28,000 \times 16/100 \times 3$ (Refer to Note 1)	13,440	13,440
Extra mileage cost	— ($10,000 \times \text{Re. } 0.50$)	5,000
	<hr/>	<hr/>
	69,440	74,440
	<hr/>	<hr/>

For 40,000 miles, contract hire is cheaper	Rs. 74,440
But for 20,000 miles, buying is cheaper	Rs. 65,600
	<hr/>
	8,840
	<hr/>

∴ It is financially better to contract hire.

(b,

	Business use	Private use
Financial Cost [Refer to (a) above]	Rs. 65,600	Rs. 8,840
Annual charges ($\text{Rs. } 6,200 \times 2$)	12,400	—
Repairs and Maintenance (Given)	4,800	9,300
Service	2,400	2,900
Tyre	—	2,000
Petrol ($\text{Rs. } 20/32 \times 20,000$)	12,500	12,500
Oil ($\text{Re. } 0.025 \times 20,000$)	500	500
	<hr/>	<hr/>
	98,200	36,040
	<hr/>	<hr/>
Total Cost ÷ 20,000 miles	4.91	1.802

Working Note 1

Interest has been calculated for three years. This has been explained by a table with assumed dates. Cost is being calculated for 1986 and 1987.

<i>Car hire charges paid as follows</i>		<i>Loan taken</i>		<i>Date of repayment of loan</i>	<i>No of years for which interest is charged</i>	<i>Reasons</i>
	Rs.		Rs.			
1-1-1986	28,000	1-1-1986	28,000	31-3-1987	2	Whole interest is relevant.
1-1-1987	28,000	1-1-1987	28,000	31-3-1988	1	Only one year interest is relevant and interest paid after 31-3-1987 is irrelevant for this purpose

Computation of standard operating rate for own fleet

Problem 7-13. Remix makes ready-mixed cement and operates a small fleet of vehicles which delivers the product to customers within its delivery area.

Maintenance records for the previous five years reveal :

<i>Year</i>	<i>Mileage of vehicles</i>	<i>Maintenance cost</i>
1	1,70,000	Rs. 13,500
2	1,80,000	14,000
3	1,65,000	13,250
4	1,60,000	13,000
5	1,75,000	13,750

Transport statistics reveal .

<i>Vehicles</i>	<i>No. of Journeys each day</i>	<i>Average tonnages carried to customers (tonnes)</i>	<i>Average distance to customers (miles)</i>
1	6	4	10
2	4	4	20
3	2	5	40
4	2	6	30
5	1	6	60

There are five vehicles operating a five-day week, for 50 weeks a year.

Inflation can be ignored.

Standard cost data include :

Driver's wages are Rs. 150 each per week.

Supervisors/relief driver's wages are Rs. 200 per week.

Depreciation, on a straight-line basis with no residue value.

	Cost	Life
Loading Equipment	Rs. 1,00,000	5 years
Vehicles	Rs. 30,000 each	5 years

Petrol/Oil costs 20 paise per mile.

Repair $7\frac{1}{2}$ paise per mile.

Vehicle licences cost Rs. 400 p.a. for each vehicle.

Insurance cost Rs. 600 p.a. for each vehicle.

Tyres cost Rs. 3,000 p.a. in total.

Miscellaneous costs Rs. 2,250 p.a. in total.

You are required to :

(a) Calculate a standard rate per tonne/mile of operating the vehicles.

(b) Comment on the use of a standard rate per tonne/mile, outlining its limitations in decision making. [ICMA (London), May 1985]

Solution.

(a) Maintenance Cost is semi-variable. Therefore, using the high/low points method of determining the variable and fixed cost :

	Miles	Cost	
High	1,80,000	Rs. 14,000	
Low	1,60,000	Rs. 13,000	
	<hr/> 20,000 <hr/>	<hr/> 1,000 <hr/>	or Re. 0.05 per mile

Total cost for 16,000 miles = Rs. 13,000

Less : Variable cost = 8,000

Therefore, Fixed cost 5,000

Vehicle Statistics

Vehicle	Journey per day	Average tonnes	Average Mile	Tonne/mile	Miles run*
1	6	4	10	240	120
2	4	4	20	320	160
3	2	5	40	400	160
4	2	6	30	360	120
5	1	6	60	360	120
				<hr/> 1,680 <hr/>	<hr/> 680 Daily <hr/>
(There are 5 days in a week)				<hr/> 8,400 <hr/>	<hr/> 3,400 weekly <hr/>
(There are 50 weeks in a year)				4,20,000	1,70,000 annually

*Miles run = Average Distance \times 2 \times Journey undertaken.

Solution :

Service Departments Production	Steam 18,000 MT	Water 7,00,000 CM	Power 30,00,000 kWh
Assumed cost per unit	x	y	z
Total cost	18,000 x	7,00,000 y	30,00,000 z
As per given data	Rs.	Rs.	Rs.
Direct materials	2,50,000	2,00,000	50,000
Direct labour	1,00,000	1,90,000	1,50,000
Direct expenses	1,60,000	1,24,000	1,20,000
Overheads	1,74,240	1,58,000	2,72,000
Total	6,84,240	6,72,000	5,92,000

Inter-Services Consumed

Steam	—	—	10,000 x
Water	56,000 y	—	1,05,000 y
Power	1,46,400 z	4,20,000 z	80,000 z

From the above information, we have the following equations :

$$18,000 x = 6,84,240 + 56,000 y + 1,46,400 z \quad \dots(i)$$

$$7,00,000 y = 6,72,000 + 4,20,000 z \quad \dots(ii)$$

$$30,00,000 z = 5,92,000 + 10,000 x + 1,05,000 y + 80,000 z \quad \dots(iii)$$

First of all, equation (ii) is solved

$$7,00,000 y = 6,72,000 + 4,20,000 z$$

$$\text{or, } y = \frac{6,72,000 + 4,20,000 z}{7,00,000}$$

$$\text{or, } y = 0.96 + 0.6z \quad \dots(iv)$$

Then equation (i) is solved,

$$18,000 x = 6,84,240 + 56,000 y + 1,46,400 z$$

$$\text{or, } 18,000 x = 6,84,240 + 56,000(0.96 + 0.6z) + 1,46,400 z$$

$$\text{or, } 18,000 x = 6,84,240 + 53,760 + 33,600 z + 1,46,400 z$$

$$\text{or, } 18,000 x = 7,38,000 + 1,80,000 z$$

$$\text{or, } x = (7,38,000 + 1,80,000 z) \div 18,000$$

$$\text{or, } x = 41 + 10z \quad \dots(v)$$

Now equation (iii) is solved,

$$30,00,000 z = 5,92,000 + 10,000 x + 1,05,000 y + 80,000 z$$

By substituting values of x and y in the above equation

$$30,00,000 z = 5,92,000 + 10,000(41 + 10z) + 1,05,000(0.96 + 0.6z) + 80,000 z$$

$$30,00,000 z = 5,92,000 + 4,10,000 + 1,00,000 z + 1,00,800 + 63,000 z + 80,000 z$$

$$27,57,000 z = 11,02,800 \quad \text{or, } z = 0.4$$

Now substitute the value of z in equation (v) and (iv),

$$x = 41 + 10z$$

$$\begin{aligned} \text{or, } x &= 41 + 10 \times 0.4 & \text{or, } x &= 45 \\ y &= 0.96 + 0.6z \\ y &= 0.96 + 0.6 \times 0.4 & \text{or, } y &= 1.20 \end{aligned}$$

Thus the unit rate of steam, water and power are :

Steam	= Rs. 45.00 per MT
Water	= Rs. 1.20 per CM
Power	= Re. 0.40 per kWh.

HOTEL COSTING

Fixing tariff for three types of suites

Problem 7-15. Ranieet Hotel has three types of suites for its customers, viz., single room, double room and three rooms respectively. State the rent to be charged for each type of suite on the basis of following information :

(i) The number of suites of each type are :

(a) Single room suites	100
(b) Double room suites	30
(c) Three room suites	20

(ii) The rent of double room suite is to be fixed as $1\frac{1}{2}$ times the single-room suite and that of three-room as twice the single room suite.

(iii) The occupancy of each type of suite is as follows :

	Summer	Winter
(a) Single room suites	90%	50%
(b) Double room suites	80%	20%
(c) Three room suites	60%	20%

(iv) The annual expenses are as follows :

(a) Staff salaries	Rs. 2,20,000
(b) Room attendant's wages when occupied .	

	Summer	Winter
Single room suites	Rs. 2	Rs. 3.00
Double room suites	3	4.50
Three room suites	4	6.00

(c) Lighting, heating and power for full month, when occupied

	Lighting	Power
Single room suites	Rs. 40	Rs. 20
Double room suites	60	30
Three room suites	80	40
(d) Repairs and renovation		Rs. 42,000
Linen etc.		45,000
Interior decoration		50,000
Sundries		31,550

(c) *Depreciation :*

Building @ 5% on Rs. 14,00,000

Furniture & Fixtures @ 10% on Rs. 1,00,000

Air-conditioner @ 10% on Rs. 2,00,000.

(v) Summer may be assumed for 7 months and winter for 5 months in a year. A month may be taken as of 30 days.

(vi) Profit including interest on investment @ 25% on cost.

Suggested Approach

In this problem total services rendered should be expressed in single room days to determine the rent for one day for single room. Rent for other rooms should be charged accordingly based on weightage given.

Solution.

Operating Cost Statement

(A) <i>Total cost</i>		<i>Per annum</i>
Staff salaries		Rs. 2,20,000
Attendant's wages (Refer to working note 2)		93,150
Repairs and renovation		42,000
Lighting (Refer to working note 3)		55,400
Power (Refer to working note 4)		27,700
Linen		45,000
Interior decoration		50,000
Sundries		31,550
Depreciation :		
Building	Rs. 70,000	
Furniture & Fixtures	10,000	
Air-conditioner	20,000	1,00,000
Total cost for the year		6,64,800
(B) Profit 25% on cost		1,66,200
(C) Total rent to be charged		8,31,000
(D) Total single room days (Refer to working note 1)		41,550 days
(E) Rent for one day		Rs. 20
(F) Rent for single room suite		20
(G) Rent for double room suite (20 × 3/2)		30
(H) Rent for three room suite (20 × 2)		40

*Working Notes*1. *Room days :*(a) *Single-room suite :*

Summer : 100 rooms \times 90% \times 30 days \times 7 months = 18,900

Winter : 100 rooms \times 50% \times 30 days \times 5 months = 7,500

Total single room days 26,400

(b) *Double-room suite :*

Summer : 30 rooms \times 80% \times 30 days \times 7 months 5,040

Winter : 30 rooms \times 20% \times 30 days \times 5 months 900

Total double room days 5,940

(c) *Three-room suite :*

Summer : 20 rooms \times 60% \times 30 days \times 7 months 2,520

Winter : 20 rooms \times 20% \times 30 days \times 5 months 600

Total three room days 3,120

Total single-room days

The rent of a double-room suite is to be $1\frac{1}{2}$ times and that of a three-room suite as twice the single-room suite.

Single-room days

Single-room suite = 26,400

Double-room suite (5,940 days \times 3/2) = 8,910

Three-room suite (3,120 days \times 2) = 6,240

41,550

2. *Room attendant's wages**Summer*

Single room suite (18,900 days \times Rs. 2) = Rs. 37,800

Double room suite (5,040 days \times Rs. 3) = 15,120

Three room suite (2,520 days \times Rs. 4) = 10,080

Winter

Single room suite (7,500 days \times Rs. 3) = 22,500

Double room suite (900 days \times Rs. 4.5) = 4,050

Three room suite (600 days \times Rs. 6) = 3,600

Total room attendants' wages 93,150

(3) *Lighting for full year*

Single room suite (26,400 days × Rs. 40)/30 days	Rs. 35,200
Double room suite (5,940 days × Rs. 60)/30 days	11,880
Three room suite (3,120 days × Rs. 80)/30 days	8,320
	<hr/> 55,400

(4) *Power for full year*

	Rs.
Single room suite (26,400 days × Rs. 20)/30 days	= 17,600
Double room suite (5,940 days × Rs. 30)/30 days	= 5,940
Three room suite (3,120 days × Rs. 40)/30 days	= 4,160
	<hr/> 27,770

Computation of hotel tariff per person (meal and accommodation)

Problem 7-16. (a) The Holiday Hotel has 40 bed-rooms with a maximum occupancy of 490 sleeper nights per week. Average occupancy is 60% throughout the year. Meals provided to guests have been costed and the average food cost per person per day is as follows :

Breakfast	Rs. 3'60
Lunch	Rs. 11'00
Dinner	Rs. 13'40
Direct wages and staff meals per week are as under :	
Restaurant and kitchen	Rs. 3,430
House keeping	Rs. 1,952
General	Rs. 1,760

Direct expenses per annum are Rs. 45,760 for house keeping and Rs. 52,000 for the Restaurant.

Indirect expenses amount to Rs. 3,41,120, which should be apportioned on the basis of floor area. The floor areas are :

Bed rooms	5,600 sq. metres
Restaurant	1,200 sq. metres
Service area	600 sq. metres

A net profit of 10% each must be made on the Restaurant takings and accommodation takings.

You are required to calculate what inclusive terms per person should be charged per day. Show the split between meals and accommodation charges.

(b) There is also a proposal to take on hire an adjoining building available and convert it into a Pastry Shop. The annual cost estimates are :

Rates and taxes	Rs. 12,000
-----------------	------------

Wages	Rs. 54,000
Replacement of utensils	Rs. 2,400
Depreciation of fixed assets	Rs. 3,600
Fuel cost	10% of the cost of Pastries

Sales are expected to average Rs. 1,50,000 per annum, the monthly figures varying according to season. Prices shown on the tags are arrived at by marking the costs up by 150%. Calculate the estimated annual profit. Also draw an estimate of cost and profit for the first month when the sales are expected to be Rs. 15,000. (I.C.W.A., Final, Dec., 1981)

Solution. Statement showing the daily hotel tariff per person

		Sleeper nights per week	
Capacity per week		490	
Actual utilized capacity (60% occupancy)		294	
		Cost per week	
Particulars	Total	Meal	Accommodation
Food cost 294 × Rs. 28	Rs. 8,232.00	Rs. 8,232.00	Rs. —
Direct wages and staff meals :			
Restaurant and kitchen	3,430.00	3,430.00	—
House keeping	1,952.00	—	1,952.00
General (apportioned in the ratio of direct wages, i.e., 3430 : 1952)	1,760.00	1,121.66	638.34
Direct expenses :			
Restaurant $\frac{\text{Rs. } 52,000}{52 \text{ weeks}}$	1,000.00	1,000.00	
House keeping $\frac{\text{Rs. } 45,760}{52 \text{ weeks}}$	880.00	—	880.00
Indirect expenses :			
	$\frac{\text{Rs. } 341,120}{52 \text{ weeks}}$		
	=Rs. 6,560 per week.		
Rs. 6,560 is apportioned on the basis of floor area			
Restaurant and service $6,560 \times (1,800 \div 5,400)$	2,186.67	2,186.67	—

OPERATING COSTING

P7-31

Bed-rooms 6,560 × (3,600 ÷ 5,400)	4,373.33	—	4,373.33
Total cost per week	23,814.00	15,970.33	7,843.67
Profit (1/10th of sales or 1/9th of cost)	2,646.00	1,774.48	871.52
Total selling price for 294 sleeper nights	26,460	17,744.86	8,715.14
Daily rate per person (Rounded off to the nearest rupee)	90.00	60.00	30.00

The daily tariff rate for Holiday Hotel should be fixed at Rs. 90 per day consisting of Rs. 60 for food and Rs. 30 for accommodation.

(b) *Estimated profit if adjoining building is taken on hire for pastry shop*

It is given that prices shown on the tags are arrived at by marking the costs up by 150%.

Suppose the cost of pastry is

Mark-up

Rs. 100

Rs. 150

Selling price

Rs. 250

If selling price is Rs. 250, then the cost = 100

If selling price is Rs. 1,50,000, then the cost = $(100 \div 250) \times 1,50,000$

= Rs. 60,000

=====

Cost of pastry per annum

Rs. 60,000

Fuel cost (10% cost of pastry)

6,000

Wages

54,000

Rent and rates

12,000

Replacement of utensils

2,400

Depreciation of fixed assets

3,600

Total cost of sales per annum

1,38,000

Selling price per annum

1,50,000

Profit

12,000

=====

Estimate of Cost and Profit for one month

When expected sale will be Rs. 15,000

Cost of pastry $(15,000 \times 100) \div 250$

Rs. 6,000

Fuel cost (10% of cost of pastry)

600

Wages (treating it as 100% variable)	
$(54,000 \times 15,000) / 1,50,000$	5,400
Rent and taxes (period cost) $12,000 / 12$	1,000
Replacement of utensils $2,400 \div 12$	200
Depreciation $3,600 \div 12$	300
Cost of sales for one month	13,500
Selling price	15,000
Profit	1,500

Note. If wages are treated as period cost, the revised profit will be :

Wages as arrived above	Rs. 5,400
Less wages (treating as fixed) $54,000 \div 12$	4,500
Impact of decrease in wages	900
Add profit as arrived above	1,500
Revised profit	2,400

Comparative profitability of letting out the hall for dance championship or exhibition

***Problem 7-17.** A local authority owns and controls a multipurpose leisure conference hall with adjacent bars and restaurants, in a seaside holiday resort. The authority has received requests for the letting of hall from :

(1) the organisers of an international Modern and Latin American dance championship, and

(2) a firm of exhibition organisers which wants to mount an exhibition of hotel and catering equipment.

The estimates of income and costs are shown below.

Dance championship

Dates hall required : Monday 16th May to Saturday 21st May, 1988, inclusive.

Income : Rs. 200 per day rent plus 25% of box office takings from visitors who pay Rs. 5 entry fee per day to watch the championships. From past experience of running this event, the organisers estimate the number of dance competitors, who do not pay at the box office, will be 1,200 (200 per day) and that there will be 14,000 paying visitors over the six-day period.

30 stalls can be let to traders who use the concourse adjoining the hall. The traders sell dance shoes, clothes, records and videos. Stall rents vary with size but if all are occupied, the rental income received by the authority for the whole period of six days will be Rs. 5,000.

Some events are to be filmed for showing on television at a later date for which the authority will receive a fee of Rs. 3,000.

Bars and restaurants can expect to take Rs. 3 per person per day for each person using the hall.

Hotel and catering equipment exhibition

400 stand units can be erected and dates required are Sunday 15th May to Wednesday 18th May, 1988, inclusive. Sunday is the preparation day for the businesses renting stands for the exhibition from the organisers. The exhibition is to be open to the trade and public on the Monday, Tuesday and Wednesday. Stands are dismantled during Wednesday evening.

The exhibition organisers believe that all the stands will be let although some exhibitors will take two or more units to constitute large stands. Exhibitors' employees average two per stand unit per day with the exception of the preparation day (Sunday) when the average is six employees per stand unit.

Although open to the public, the exhibition is primarily for the trade, i.e., for buyers of hotel and catering equipment, which is what prompted the organisers to select a holiday resort. The exhibition organisers are offering Rs. 8,000 rent for the four-day period plus 20% of receipts from visitors. It is expected that 4,600 visitors will each pay Rs. 2.50 to enter the exhibition over the three-day period.

It is estimated that all the exhibitors' employees will spend Rs. 6 each per day in the bars and restaurants and that each visitor to the exhibition will spend an average Rs. 2. Authority employees, some of whom are temporary part-time staffing the hall, bars and restaurants are listed below. Box office staff are engaged on other duties within the hall when it is not open to the public. Assume that the weekly payments are variable with the days the hall is in use and are based on a 6-day working week.

	<i>Weekly wage Rs.</i>	<i>Number required for duty</i>	
		<i>Dance championship</i>	<i>Exhibition</i>
Managers	300	4	2
Box office staff	200	9	6
Attendants/security staff	150	20	20
Restaurant and bar staff	200	10	6
Restaurant and bar staff	120	100	60

Variable costs :

Energy costs Rs. 200 } *per day the hall is in use*
 Cleaning contractors Rs. 300 }

Employee-related costs are 10% of *total* variable staff costs.

Fixed costs are expected to be incurred as follows :

	<i>Per annum</i>
Manager and support staff permanently on site	Rs. 60,000
Electrical, lighting and maintenance staff	1,00,000
Depreciation on fittings and equipment	80,000
Insurance	20,000

A gross profit of 45% is expected from all bar and restaurant receipts the gross profit represents sales, less cost of food, beverages and drinks.

Ignore inflation and income tax

You are required to :

- prepare a comparative statement showing the income and expenditure relating to letting the hall for
 - the dance championship, and
 - the exhibition ;
- calculate the average surplus contribution per day of use for each proposal ;
- recommend to the authority which proposal should be accepted, together with *two* reasons supporting your choice ;

(C.I.M.A. London, Nov. 1986 Adapted)

Solution. (a) (1)	Dance Championship
<i>Income</i>	Rs.
Hall rent : 6 days \times Rs. 200	1,200
Box office receipts : 14,000 \times Rs. 5 \times 25%	17,500
Stall rents	5,000
Television fee	3,000
Bar and restaurant sales :	
15,200 \times Rs. 3 \times 45% =	20,520
	<hr/> 47,220
Expenditure :	
Staff	
Managers 4 \times Rs. 300	= Rs. 1,200
Box office staff 9 \times Rs. 200	= 1,800
Attendant/Security staff	
20 \times Rs. 150 =	3,000

OPERATING COSTING

P7-35

Bar and restaurant staff			
	$10 \times \text{Rs. } 200 =$	2,000	
Bar and restaurant staff			
	$100 \times \text{Rs. } 120 =$	12,000	
			20,000
Others :		Rs.	
10% Staff costs		2,000	
Energy costs :			
6 days \times Rs. 200 per day		1,200	
Cleaning 6 days \times Rs. 300 per day		1,800	
			5,000
			25,000
Surplus Contribution			22,220
			== =

(a) (2) The Exhibition

Income

Hall rent		Rs. 8,000
Box office receipts $4,600 \times \text{Rs. } 2.50 \times 20\%$		2,300
Bar and restaurant sales		
$400 \times 6 \times \text{Rs. } 6$	Rs. 14,400	
$400 \times 2 \times 3 \times \text{Rs. } 6$	14,400	
$4,600 \times \text{Rs. } 2$	9,200	
	$38,000 \times 45\%$	17,100
		27,400

Expenditure :

Staff

Managers : $2 \times \text{Rs. } 300 \times 2/3 =$	Rs. 400	
Box office : $6 \times \text{Rs. } 200 \times 2/3 =$	800	
Attendant Security		
$20 \times \text{Rs. } 150 \times 2/3 =$	2,000	
Bar and Restaurant		
$6 \times 200 \times 2/3 =$	800	
Bar and Restaurant $60 \times 120 \times 2/3$	4,800	
		8,800
Others :		
10% of staff costs	880	
Energy costs :		
4 day \times Rs. 200 per day	800	
Cleaning : 4 days \times Rs. 300 per day	1,200	
		2,880
		11,680
Surplus from Exhibition		15,720

(b) Average surplus contribution per day of use for each proposal

Dance championship = Rs. $22,220 \div 6$ days
= Rs. 3703.33

Exhibition = Rs. $15,720 \div 4$ days = Rs. 3,930.

(c) Recommendation

The hall should be let out for dance championship, because surplus contribution of Rs. 22,220 is better than surplus contribution of Rs. 15,720. Per day surplus for this decision is not relevant, as the aim of local authorities should be to improve total collection. This decision presumes that no other alternative except these two is available during the period from 15th May 1988 to 21st May 1988.

HOSPITAL COSTING

Problem 7-18. Public Health Centre runs an Intensive Medical Care Unit. For this purpose, it has hired a building at a rent of Rs. 5,000 per month with the understanding that it would bear the repairs and maintenance charges also.

The unit consists of 25 beds and 5 more beds can be comfortably accommodated when the occasion demands. The permanent staff attached to the unit is as follows :

2 Supervisors, each at a salary of Rs. 500 per month.

4 Nurses, each at a salary of Rs. 300 per month.

2 Ward boys, each at a salary of Rs. 150 per month.

Though the unit was open for the patients all the 365 days in a year, scrutiny of accounts in 1979 revealed that only for 120 days in the year, the unit had the full capacity of 25 patients per day and for another 80 days, it had on an average 20 beds only occupied per day. But, there were occasions when the beds were full, extra beds were hired at a charge of Rs. 5 per bed per day and this did not come to more than 5 beds extra above the normal capacity on any one day. The total hire charge for the extra beds incurred for the whole year amount to Rs. 2,000.

The unit engaged expert doctors from outside to attend on the patients and the fees were paid on the basis of the number of patients attended and time spent by them and on an average worked out to Rs. 10,000 per month in 1979.

The other expenses for the year were as under :

Repairs and Maintenance	Rs. 3,600
Food supplied to patients	44,000
Janitor and other services for them	12,500
Laundry charges for their bed linen	28,000
Medicines supplied	35,000

Cost of oxygen, X-ray etc., other than directly borne for treatment of patients	54,000
General Administration charges allocated to the unit	49,550

- (i) If the unit recovered an overall amount of Rs. 100 per day on an average from each patient, what is the profit per patient-day made by the unit in 1979.
- (ii) The unit wants to work on a budget for 1980, but the number of patients requiring intensive medical care is a very uncertain factor. Assuming that same revenue and expenses prevail in 1980, in the first instance, work out the number of patient-days required by the unit to break even.

(U.C.W. 1, Final, June 1980)

Solution. (i) Number of Patient-days in 1979

25 beds \times 120 days	3,000
20 beds \times 80 days	1,600
Extra bed-days (total hire charges of extra beds \div charges per bed per day = Rs. 2,000 / Rs. 5)	400
	<hr/> 5,000 patient-day

In order to calculate contribution, the profit per patient-day and the break-even point, it is necessary to classify the different costs into fixed and variable categories. It will be seen that while most of the items can be easily classified as fixed or variable, problem arises in respect of two items, viz., Janitor and other services for the patients and the cost of oxygen, X-ray, etc. It is presumed that the cost of Janitor and other services is variable on the presumption that they are related to number of patient-days. On the other hand, cost of oxygen, X-ray etc., has been taken as a fixed cost since it has been stated that this cost is other than costs directly borne for treatment of patients.

Statement of Profit

Income received (Rs. 100 \times 5,000 patient-days)		Rs. 5,00,000
Variable Costs :		
Food	Rs. 44,000	
Janitor services	12,500	
Laundry	21,600	
Medicines	35,000	
Doctor's fees (Rs. 10,000 \times 12)	1,20,000	
Hire charges for extra beds	2,000	Rs. 2,41,500
Contribution		<hr/> 2,58,500

Fixed Costs :

Salaries ($2 \times \text{Rs. } 500 + 4 \times \text{Rs. } 300 + 2 \times \text{Rs. } 150$) $\times 12$	Rs.	
	30,000	
Rent ($\text{Rs. } 5,000 \times 12$)	60,000	
Repairs and Maintenance	3,600	
General Administration	49,550	
Cost of oxygen, X-ray etc.	54,000	1,97,150
Profit		Rs. 61,350

Profit per patient-day

$$= \text{Rs. } 61,350 \div 5,000 = \text{Rs. } 12.27$$

(ii) *Break-even point*

$$S - V = F + P$$

Multiply and divide RHS by S,

$$S(S - V) \div S = F \quad (\because \text{at BEP, value of P is not})$$

$$\text{B.E. point} = (\text{Fixed cost} \div \text{Contribution}) \times \text{Gross Income}$$

$$= (1,97,150 \div 2,58,500) \times 5,00,000$$

$$\text{or Rs. } 3,81,335 \quad \text{or } 3,81,335 \div 100$$

$$\text{or } 3,813 \text{ patient-days.}$$

Authors' Special Notes

1. Refer to Problem 7-2 to remember how tonne and kilometre are linked to determine operating charges of vehicle carrying load. This problem has been asked several times in various examinations.

2. Problem 7-1. Half-fare students expressed in terms of full-fare students—use of 'equivalent concepts'.

3. At 'final level' direct questions are not asked. Note (i) Problem 7-10—Economics of replacement in operating costing (ii) Problem 7-11—Choice of alternative modes by transport, i.e., decision making questions on Operating Costing.

BREAK-UP OF THE PROBLEMS RELATING TO OPERATING COSTING ACCORDING TO DIFFERENT LEVELS (FOR PROBLEMS WITH PREFIX A, REFER TO APPENDIX A)

Intermediate Level

Transport Costing—P 7-1, 7-2, 7-3, 7-4, 7-5, 7-6, 7-7, 7-9A 20

Power House Costing—P 7-14

Hotel Costing—P 7-15.

Final Level

Transport Costing—P 7-8, 7-10, 7-11, 7-12, 7-13

Hotel Costing—P. 7-16, 7-17

Hospital Costing—P 5-12.

Please also refer to the Examples 8-1 to 8-5 of the book "Advanced Cost and Management Accounting—Text" by Saxena and Vashist.

Joint Products and By-Products

[Simple Problems 8.1; Apportionment of Joint Costs (Further processing) 8.2—8.12; Miscellaneous 8.13—8.14]

SIMPLE PROBLEMS

Apportionment on weight basis

Problem 8.1. One tonne of raw material put into a common process yields four joint products P, Q, R and S, their weight being 63 kgs., 117 kgs., 180 kgs. and 540 kgs. respectively. The balance in weight is considered as normal wastage.

Based on the total processing cost of Rs. 20,000 per tonne of raw material input, you are required to apportion the joint cost to products P, Q, R and S. (C.S., Final, Dec., 1986)

Solution. Apportionment of Joint Cost on weight basis

Product	Yield	$\text{Yield} \div \text{Output} \times \text{Total Processing Cost}$	Apportioned Joint Cost
P	63 kgs	$(63 \div 900) \times 20,000$	Rs. 1,400
Q	117	$(117 \div 900) \times 20,000$	2,600
R	180	$(180 \div 900) \times 20,000$	4,000
S	540	$(540 \div 900) \times 20,000$	12,000
Total output	900*		20,000
Normal loss (balance)	100		—
Input	1,000		20,000

APPORTIONMENT OF JOINT COSTS

Problem 8.2 (Apportionment of Joint Costs) "If the products are truly joint products, the cost of process can be applied to these products :

- (1) On the basis of the weight or other physical quantity of each product.
- (2) In respect of the marginal cost of the process on the basis of physical quantities and in respect of the fixed costs of the process on the basis of the contribution made by the various products.
- (3) On the basis of the selling values of the different products."

Using the following figures in respect of the joint production of A and B for a month, show the apportionment of joint costs and profits made, on the above three bases.

Total Cost—Direct Materials	Rs. 26,000
Direct Labour	10,000
Variable Overhead	8,000
Fixed Overhead	22,000
Sales A—100 tonnes @ Rs. 600 per tonne	
B—120 tonnes @ Rs. 200 per tonne.	

(J.C.W.A. Inter, December 1987)

Solution : First of all, overall profitability is to be found out :

Sales : A	100 × Rs. 600	Rs. 60,000
B	120 × Rs. 200	24,000
Total sales		84,000
Less : Marginal cost :		
Direct materials	Rs. 26,000	
Direct labour	10,000	
Variable Overhead	8,000	
		44,000
Contribution		40,000
Less : Fixed cost		22,000
Profit		18,000

Apportionment of Joint Costs(i) **On the basis of weight :**

Marginal cost	Rs. 44,000
Fixed cost	22,000
Joint costs to be apportioned	66,000

Product	Weight (Tonne)	Apportioned Costs	Sales	Profit/(Loss)
A	100	Rs. 30,000	60,000	30,000
B	120	36,000	24,000	(12,000)
	220	66,000	84,000	18,000

(ii) **Marginal cost on the basis of weight and fixed costs on the basis of contribution :**

Product	Production (Tonne)	Contribution	Marginal Cost	Fixed Cost	Total Cost	Sales	Profit
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	
A	100	40,000*	20,000	22,000	42,000	60,000	18,000
B	120	—	24,000	—	24,000	24,000	—
	220	40,000	44,000	22,000	66,000	84,000	18,000

*Entire Contribution is from Product A.

(iii) On the basis of Sales

Product	Sales	Prorated Cost	Profit
A	Rs. 60,000	Rs. 47,143	Rs. 12,857
B	24,000	18,857	5,143
	<u>84,000</u>	<u>66,000</u>	<u>18,000</u>

Problem 8-3 (Further processing) A company produces product *N* which is sold at Rs. 25 per kg. Before the product *N* emerges as finished product, it undergoes processing in three processes viz. *P*, *Q* and *R*. Three types of raw materials viz. *A*, *B* and *C* are charged in the ratio of 50 : 30 : 20 into Process 'P' where a process loss of 20% on total input is incurred. The output of process 'P' is transferred to Process 'Q' where a process loss of 10% on input is incurred. The output of process *Q* in turn is transferred to Process 'R' whose output is as under :—

Main Product	<i>N</i>	80%
By Product	<i>G</i>	20%

The by-product *G* can be sold at Rs. 8 per kg at split off stage. Alternatively it can be processed further in Department *S* by addition of material *K* equivalent to 50% of the weight of the input of by-product. In that event the processed product *GK* can be sold at Rs. 14 per kg. The process loss in this operation is 40% of the total input. The costs of this process are : Material *K* Rs. 4/- per kg.

Variable costs Rs. 2 per kg of the total input into the process including by-product *G*.

Fixed expenses Rs. 10,125 per month.

In December 1987 the Company is poised for a production 9,000 kgs. of product *N*. Additional information relating to this month are :

Material Price *A* Rs. 8 per kg. *B* Rs. 6 per kg. *C* Rs. per kg.

Process costs : Process Variable costs per kg of input. Fixed costs

<i>P</i>	Rs. 2.00	Rs. 10,000
<i>Q</i>	1.50	5,000
<i>R</i>	2.00	4,850

Required :

- Present a statement showing the profitability of product '*N*' and sale of '*G*' as by-product.
- Evaluate the economics of processing the by-product '*G*' into '*GK*'.
- State your recommendations on the advisability of further processing of by-product '*G*'. (I.C.W.A. Final, December 1987)

Solution.

- Production of *N* = 9,000 kg.

It is 80% of output of *R*.

∴ Output of *R* = $(9,000 \div 80) \times 100 = 11,250$ kg.

∴ By-Product *G* = 11,250 kg — 9,000 kg = 2,250 kg.

Output of *B* is equal to input of *Q*

∴ Input to Q = $(11,250 \div 90) \times 100 = 12,500$ kg.

Input to P = $(12,500 \div 80) \times 100 = 15,625$ kg.

Process P*Cost of raw material*

Material	Mix.	Qty.	Price	Value
A	50%	7812.5 kg.	Rs. 8.00	Rs. 62,500
B	30%	4687.5 kg.	6.00	28,125
C	20%	3125.0 kg.	5.00	15,625
Total		15,625 kg.		1,06,250
Variable Cost	$15,625 \times \text{Rs. } 2.00$			31,250
Fixed Exp.				10,000
Total				1,47,500

Process Q : Input = 12,500 kg.

Input from Process P	Rs. 1,47,500
Variable Cost $12,500 \text{ kg} \times \text{Rs. } 1.50$	18,750
Fixed Expenses	5,000

Total	Rs. 1,71,250
-------	--------------

Process R – Input is 11,250 kg.

Input from Q	Rs. 1,71,250
Variable Cost $(11,250 \times \text{Rs. } 2)$	22,500
Fixed Cost	4,850

1,98,600

Less : Sales of By-Product

$2,250 \times \text{Rs. } 8$	18,000
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Cost of N	1,80,600
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Profit on N	44,400
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Sales of N $(9,000 \times \text{Rs. } 25)$	2,25,000
--------------------------------------------	----------

(ii) **By-product processing**

Direct Material $(2,250 \div 2) \times \text{Rs. } 4$	Rs. 4,500
-------------------------------------------------------	-----------

Variable Cost $3,375 \times \text{Rs. } 2$	6,750
--------------------------------------------	-------

Fixed Exp.	10,125
------------	--------

Incremental Cost of Processing	21,375
--------------------------------	--------

Finished Product = $3,375 \times 0.60 = 2025$ kg.

Sales of GK $2,025 \times \text{Rs. } 14$	28,350
-------------------------------------------	--------

Sales of G $2,250 \times \text{Rs. } 8$	18,000
-----------------------------------------	--------

Incremental Revenue	10,350
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∴ By product G should not be processed further.

Selling the products at split-off point or after further processing

Problem 8.4. In an Oil Mill four products emerge from a refining process. The total cost of input during the quarter ending March 1983 is Rs. 1,48,000. The output, sales and additional processing costs are as under :

<i>Products</i>	<i>Output in Litres</i>	<i>Additional processing cost after split off point</i>	<i>Sales value</i>
AOXE	8,000	Rs. 43,000	Rs. 1,72,500
BOXE	4,000	9,000	15,000
COXE	2,000	—	6,000
DOXE	4,000	1,500	45,000

In case these products were disposed off at the split off point that is before further processing, the selling price would have been :

<i>AOXE</i>	<i>BOXE</i>	<i>COXE</i>	<i>DOXE</i>
Rs. 15'00	Rs. 6'00	Rs. 3'00	Rs. 7'50

Prepare a statement of profitability based on :

- (1) If the products are sold after further processing is carried out in the mill.
- (2) If they are sold at the split off point. (C.A. Inter, May 1983)

Solution. (i) **Statement of profitability of an Oil Mill (after carrying out further processing) for the quarter ending 31st March 1983**

<i>Products Name</i>	<i>Sales value after further pro- cessing</i>	<i>Share of Joint cost</i>	<i>Additional processing cost</i>	<i>Total cost after processing</i>	<i>Profit (loss)</i>
AOXE	Rs. 1,72,500	Rs. 98,667	Rs. 43,000	Rs. 1,41,667	Rs. 30,833
BOXE	15,000	19,733	9,000	28,733	(13,733)
COXE	6,000	4,933	—	4,933	1,067
DOXE	45,000	24,667	1,500	26,167	18,833
	2,38,500	1,48,000	53,500	2,01,500	37,000

(ii) Statement of profitability at the split off point

<i>Products' Name</i>	<i>Selling price at split off</i>	<i>Output in units</i>	<i>Sales value at split off point</i>	<i>Share of joint cost</i>	<i>Profit at split off point</i>
AOXE	Rs. 15	Rs. 8,000	1,20,000	Rs. 98,667	Rs. 21,333
BOXE	6	4,000	24,000	19,733	4,267
COXE	3	2,000	6,000	4,933	1,067
DOXE	7'50	4,000	30,000	24,667	5,333
			1,80,000	1,48,000	32,000

Selling at split off point or after further processing

Problem 8·5. Chem and Co. Ltd. produces two products 'J' and 'K' in Department 'A' from a basic raw material. The input ratio of Department A is 100 : 90. Product 'J' which becomes the input of Department 'B' can be further processed in Department 'B' to make one of the most popular industrial product 'N'. The input-output ratio of Department 'B' is 100 : 95. Alternatively product 'J' can also be sold at the split off stage.

The selling prices are

Product	Rs./kg.
J	29·40
K	26·00
N	31·50

The departmental expenses, production data and selling expenses envisaged in the budget for 1986 are as under :

(a) *Departmental expenses :*

	A Rs. lacs	B Rs. lacs
Raw Materials Rs. 16 per kg.		
Direct Materials	10·00	3·00
Direct Wages	15·00	5·00
Variable Overheads	20·00	7·00
Fixed Overheads	25·00	1·00

(b) *Production data :*

Product	kg.
N	4,75,000
K	8,50,000

(c) *Selling expenses :*

Product	Rs.
J	1,00,000
K	2,00,000
N	2,00,000

You are required to :

(i) Prepare a statement showing the apportionment of joint costs between products 'J' and 'K'.

(ii) Advise whether the Company should process 'J' further into product 'N' or not. Show workings.

(iii) Present a statement of profitability based on your decision.

(C.A. Final, Nov. 1985)

Solution. (i) First of all, joint costs of Department 'A' should be found out. All elements of costs are given but raw materials cost is not indicated and therefore, raw materials consumption of Department A is to be worked out :

Output of Product N (produced in Deptt. B) = 4,75,000 kg.

Efficiency of Department *B* is 95%,

Input of Deptt. *B* = $4,75,000 \div 95\% = 5,00,000$ kgs.

Input of Deptt. *B* = Output of Product *J*

Therefore, Output of Product *J* = 5,00,000 kg.

The output of Deptt. '*J*' *A* = 5,00,000 kg. + 8,50,000 = 13,50,000 kg.

Efficiency of Deptt. *A* is 90%,

Input of Deptt. *A* = $13,50,000 \div 90\% = 15,00,000$ kg.

Joint Costs of Deptt. A

Raw Materials (15,00,000 × Rs. 16)	= Rs. 240 lacs
Materials	10
Direct Wages	15
Variable Overheads	20
Fixed Overheads	25
Total Joint Costs	310

Apportionment of Joint Costs between Products *J* & *K*

	<i>Product J</i>	<i>Product K</i>	<i>Total</i>
Production (kgs)	5,00,000	8,50,000	
Selling price per kg (Rs.)	29.40	26.00	
Sales value (Rs. lacs)	147	221	368
Less : Selling expenses	1	2	3
Market value at split-off point	146	219	365
Percentage	40%	60%	100%
Joint Costs apportioned in the ratio of 40 : 60	124	186	310

(ii) Profitability of further processing *J* into Product *N*

Joint costs of Product <i>J</i>	Rs. 124 lacs
Direct materials	3
Direct wages	5
Variable Overheads	7
Fixed overheads	10
Total costs of production of Product <i>N</i>	149
Selling expenses	2
Total costs of sales	151.000
Sales value of <i>N</i> (4,75,000 × Rs. 31.50)	149.625
Loss	1.375

Profitability if Product J is not further processed

Joint costs of Product J	Rs. 124 lacs
Add : Selling expenses	1
	<hr/>
Total cost	125
Add : Fixed overheads of Deptt. B to be borne by Product J	10*
	<hr/>
	135
Sales value of Product J (5,00,000 × 29.40)	147
	<hr/>
Profit	12
	<hr/>

Further processing is, therefore, not recommended.

*It is assumed that fixed overheads of Deptt. B is committed and the same are borne by Product J.

(iii) PROFITABILITY

	Product J	Product K	Total
	<hr/>	<hr/>	<hr/>
Apportioned Joint cost as at (i)	Rs. lacs 124	180	• 310
Add : selling expenses	1	2	3
	<hr/>	<hr/>	<hr/>
Total costs	125	188	313
Sales value	147	221	368
	<hr/>	<hr/>	<hr/>
Gross Profit			55
Less : Fixed expenses of Deptt. B			10
			<hr/>
Net Profit			Rs. 45 lacs
			<hr/>

Profitability of a by-product and Joint products

Problem 8.6. A manufacturing unit imports Raw Material and processes it to produce three different products viz. Bright, Light and White. The raw material has F.O.B. value of Rs. 5 per kg. freight and insurance are charged at 10% F.O.B price. Customs duty at 120% of C.I.F. is levied at the time of import. Auxiliary duty at 20% is also charged on C.I.F. price. Countervailing duty is charged on C.I.F. plus duty at 10%. The landed cost includes 5% for clearing charges.

* Bright and Light are joint products while White emerges as a by-product. The value of by-product after deducting 30% (10% being notional profit and 20% for selling expenses) from sale value is credited to process account. The unit consumed 4,000 kgs raw materials during a year. The relevant data is as under :

	Bright	Light.	White.
Production and sale Kg.	1,400	1,600	1,000
Selling price Rs. per Kg.	30	26	12

Further processing cost Rs. 1,500 1,000 —

Assuming additional processing cost other than material at Rs. 15,800 for all products (includes Rs. 800 for White), prepare a statement showing :-

- (a) Credit to process A/c. for by-product sale ;
 (b) Allocation of joint costs on relative sale value basis ; and
 (c) Profit on each product. (I.C.W.A. Final, December 1985, R.S.)

Solution : (a) Credit to process A/c for by-products sale (White)

Sale value (1000 kg × Rs 12)	Rs. 12,000
Less : Notional Profit (10% of sale value)	1,200
Estimated total cost.	10,800
Less : Selling exp. (20% of 12,000)	2,400
	8,400
Less : Additional processing cost	800
Estimated Joint Cost credited to process account.	7,600

(b) Joint Cost :

Raw material at F.O.B. (4,000 kg × Rs. 5)	Rs. 20,000
Freight and Insurane 10%.	2,000
C.I.F.	22,000
Custom duty 120%	26,400
Auxiliary Duty 20%	4,400
C.I.F. plus Duty.	52,800
Countervailing duty (10% on above)	5,280
	58,080
Clearing Charges (5% of 58,080)	2,904
Landed Cost of Raw material	60,984
Additional processing. (Rs. 15,800—Rs. 800)	15,000
Total Joint Cost	75,984
Less : Credit from White	7,600
Joint Cost of Bright & Light	68,384

Allocation of joint cost is to be on sale value

	Bright	Light	Total
Sales value 1400 × 30 = Rs. 42,000	1600 × 26 = Rs. 41,600	Rs. 83,600	
Joint Cost	34,356	34,028	68,384
(in ratio of 420 : 416)			

(c) Statement of profit on each product (Rs.)

	<i>Bright</i>	<i>Light</i>	<i>White</i>	<i>Total</i>
Joint process cost	34,356	34,028	7,600	75,984
Further processing	1,500	1,000	800	3,300
Selling exp.	—	—	2,400	2,400
Total cost	35,856	35,028	10,800	81,684
Profit	6,144	6,572	1,200	13,916
Sale	42,000	41,600	12,000	95,600

Selling at split off point or after further processing (Direct Labour being limiting factor)

Problem 8.7. Fine Chemicals Ltd. produces A, B, C from a common mixing process. The products are made in batches and from an input of 1,100 kg of material the standard output is :

A	400 kg.
B	300
C	200
By-product	100

Waste has no value.

The common costs per batch for the mixing process are :

Direct material (1,100 kg)	Rs. 440
Direct labour (100 hrs).	300
Variable overhead	200

Fixed overheads in the mixing department are budgeted at Rs. 2500 per month. The normal production is 100 batches per month.

The products are all capable of further processing. The company has idle space available. Additional capital equipment will be required at a cost of Rs. 1,20,000 to be depreciated over 5 year period on a straight line basis with no residual value. Rent, rates and other fixed costs of further processing are budgeted to be Rs. 15,000 per month.

	<i>A</i> per kg	<i>B</i> per kg	<i>C</i> per kg
Direct materials	Rs. 1.00	Rs. 0.50	Rs. 0.80
Direct labour	1.50	3.00	2.25
Variable overhead	1.00	2.00	1.50

Direct wages are Rs. 3 per hour and variable overhead is calculated at Rs. 2 per hour. The sales value of products before and after further processing are :

	<i>At split-off point</i>	<i>After further processing</i>
	per kg	per kg
<i>A</i>	Rs. 1.25	Rs. 5.35
<i>B</i>	1.50	7.15
<i>C</i>	2.00	7.55
By-product	0.50	0.50

Only 25,000 direct labour hours will be available for further processing during the coming year.

Required :

(a) A statement showing the budgeted monthly results if further processing is not undertaken.

(b) Assuming that at the end of financial year 20% of the output for one month from the mixing department was in stock, show the valuations, which two alternative methods of valuation would give.

(c) Give calculations and recommendations on the most profitable use of direct labour hour in further processing

(I.C.W.A. Final, June 1986)

Solution : (a) Statement showing the budgeted monthly results, if further processing is not undertaken.

	<i>A</i>	<i>B</i>	<i>C</i>	<i>By Product</i>	<i>Total</i>
Standard Output (kg)	40,000	30,000	20,000	10,000	1,10,000
Split-off price Rs.	1.25	1.50	2.00	0.50	
Sales Value Rs.	50,000	45,000	40,000	5,000	1,40,000
<i>Common Cost (allocated according to units)</i>					
Material	17,600	13,200	8,800	4,400	44,000
Direct Labour (10,000 hrs.)	12,000	9,000	6,000	3,000	30,000
Variable overhead	8,000	6,000	4,000	2,000	20,000
	37,600	28,200	17,800	9,400	94,000
Contribution	12,400	16,800	21,200	(4,400)	46,000
Fixed Overhead (Allocated on unit basis 4 : 3 ; 2 : 1)	10,400	7,800	5,200	2,600	26,000
Profit/loss	2,000	9,000	16,000	(7,000)	20,000

(b) Stock valuation has been attempted below by using (i) Units produced and (ii) Net Realisable value at split-off point method.

Units produced method (In Rupees)

	A	B	C	By product	Total
Cost Refer to (a)					
Variable	37,600	28,200	18,800	9,400	94,000
Fixed	10,400	7,800	5,200	2,600	26,000
Total	48,000	36,000	24,000	12,000	1,20,000
Cost per kg.	1.20	1.20	1.20	1.20*	
Closing Stock					
20% of output (kg.)	8,000	6,000	4,000	2,000	
Value of Stock (Rs.)	9,600	7,200	4,800	2,400	24,000

*Restricted to Re. 0.50 since stock is valued at lower of cost or market price whichever is lower.

Net Realisable Value at split-off point

	Output	Split-off price (Rs.)	Sales Value	Allocated Cost	Per kg.	Value of C-Stock
A	40,000	1.25	50,000	42,857*	1.0714	8,572
B	30,000	1.50	45,000	38,571	1.2857	7,714
C	20,000	2.00	40,000	34,286	1.7143	6,857
By product	10,000	0.50	5,000	4,286	0.4286	857
	1,00,000		1,40,000	1,20,000		25,000

*(1,20,000 ÷ 1,40,000) × 50,000 and so on.

Statement showing most profitable use of D.L. Hours in further processing

	A	B	C
Sale value after further processing (Rs.)	5.35	7.15	7.55
Sales value before further processing	1.25	1.50	2.00
Additional sale value	4.10	5.65	5.55
Addl. Variable cost	3.50	5.50	4.55
Addl. Contribution	0.60	0.15	1.00
Time required for further processing (Hr.)	$\frac{1}{2}$	1	$\frac{3}{4}$
Additional contribution per DLH	Rs. 1.20	0.15	1.3333
Ranking	II	III	I
DLH available p.a.			25,000
Contribution from product (25,000 × 1.33)			Rs. 33,333
Less: Addl. Fixed cost (1,80,000 ÷ 12,000)			1,50,000
Loss on further processing			1,58,667

Recommendation. The company should not process the product C further as it will result in loss of Rs. 1,58,667.

Further Processing (Incremental approach)

Problem 8.8. A chemical factory produces four products from a single raw material. The cost of raw material for a year is Rs. 67,000 and the initial processing costs amounted to Rs. 1,28,200. All the four products viz. A, B, C and D are produced simultaneously at a single split off point. Product C is sold immediately without any further processing. A, B and D are processed further. The output, sales and further processing costs are :

Product	Output in units	Sales Rs.	Further processing cost Rs.
A	4,00,000	1,92,000	40,000
B	89,725	58,000	32,000
C	5,000	8,000	—
D	9,000	60,000	1,000

If these products were sold out at the split off point the prices attained per unit would be A=Re. 0.32 ; B=Re. 0.40 ; C=Rs. 1.60 ; D=Rs. 5.00.

Using the concepts of relevency of costs and differential costs, advise your management whether further processing should be undertaken or not.
(I.C.W.A. Final, June 1984—Adapted]

Solution.**Joint costs**

Raw Material	Rs. 67,000
Initial Processing Cost	Rs. 1,28,200
Total	1,95,200

Apportionment of Joint Cost

Product	Joint costs	Output (units)	Price/Unit at split off stage Rs.	Sales Value Rs.	Apportionment of Joint cost
A		4,00,000	0.32	1,28,000	1,15,200
B		89,725	0.40	35,890	32,300
C		5,000	1.60	8,000	7,200
D		9,000	5.00	45,000	40,500
	1,95,200			2,16,890	1,95,200

The decision to be taken is whether or not to process the products A, B and D. The additional charges which are relevant to decisions are, therefore, relevant cost. The position is as under :

Product	Cost at Split off point	Cost of further Pro- cessing	Differential cost
A	Rs. 1,15,200	Rs. 1,55,200	Rs. 40,000
B	32,300	64,300	32,000
D	40,500	41,500	1,000
			<u>73,000</u>

Differential Revenue are as under

Product	Revenue before processing	Revenue after processing	Differential revenue (In Rupees)
A	1,28,000	1,92,000	64,000
B	35,890	58,000	22,110
D	45,000	60,000	15,000
	<u>2,08,890</u>	<u>3,10,000</u>	<u>1,01,110</u>

Since differential revenue is more than differential cost in case of A and D, further processing of these products should be undertaken to maximise profits.

Further processing vs. selling at split-off point (Joint Products and By-Products)

***Problem 89.** The Management Team of Exe Ltd. is considering the possibility of undertaking a single production process which jointly produces four products in standard proportions. The output from each product is 10 kg. of raw material input into the process together with net realisable value per kg. of output immediately after the split-off point is :

Material	Output per 10 kg. input	Net realisable value per kg. of output
A	4 kg.	Rs. 8
B	3	4
C	2	10
D	1	2

The cost of processing each 10 kg. input batch are Rs. 12 and cost of the raw material input is Rs. 4 per kg.

For each of the four materials jointly produced there is the possibility of further processing before sale. The further processing will entail both manual operation and mechanical processing as well as incurring some costs directly attributable to each product. Details of resources used in, and costs incurred by, the further processing as well as the final price per kg. are :

Material	Machine hours	Labour hours	Other direct costs	Sales price
A	2	1	Rs. 4	Rs. 17
B	6	1	2	13
C	4	5	3	36
D	2	2	2	9

"Other direct costs" are variable costs but exclude the cost of labour, also a variable cost at Rs. 3 per labour hour. Apart from "other direct costs" and labour costs, all other costs of this further processing are fixed and are expected to amount to Rs. 3,40,000 per annum.

Exe Ltd. has the opportunity to process 1,00,000 kg. of the basic raw material per year and machine capacity is capable of fully processing this amount.

The Managing Director feels that all products which are subjected to further processing must be treated as joint products and all products sold immediately after the split-off point without further processing are to be treated as by products of the original process. The net costs of the joint process are allocated to the joint products in proportion to the contribution of each product line, after considering the marginal costs after the split-off point and sales revenues.

However, the Managing Director is uncertain whether the Rs. 3,40,000 fixed production costs of further processing should be allocated to products in accordance with machine or labour hours.

Required: (a) specify which of the jointly produced materials should be subject to further processing if the joint process is carried out.

(b) Produce a product profitability report for the joint products, utilizing the Managing Director's approach to the determination of joint and by-products for each of the methods of allocating fixed production overhead, he has mentioned. You may assume all production will be sold.

(C.A. Final, May, 1986)

Solution. (a) Statement showing profitability of the products subject to the further processing.

(Rs. Per unit)

	Materials			
	A	B	C	D
Selling price	17	13	36	9
<i>Variable costs</i>				
Labour cost (Labour hrs. × Rs. 3)	3	3	15	6
Other direct costs	4	2	3	2
Total variable cost	7	5	18	8
Contribution	10	8	18	1
Net realisable value after split-off point (without further processing)	8	4	10	2
Gains (Loss) of further processing	2	4	8	(1)
Ranking	3	2	1	—

Materials *C*, *B* and *A* should be processed further since they yield profit by further processing. Material *D* should be sold as it is without further processing.

(b) **Profitability of the joint products when fixed overheads are allocated on machine hours basis.**

	<i>Products</i>			
	<i>A</i>	<i>B</i>	<i>C</i>	<i>Total</i>
Production (kg.)	40,000	30,000	20,000	
Sales	Rs. 6,80,000	Rs. 3,90,000	Rs. 7,20,000	Rs. 17,90,000
<i>Costs</i>	<i>A</i>	<i>B</i>	<i>C</i>	<i>Total</i>
Joint cost*	2,00,000	1,20,000	1,80,000	5,00,000
Labour cost	1,20,000	90,000	3,00,000	5,10,000
Other direct costs	1,60,000	60,000	60,000	2,80,000
Fixed overhead @	80,000	1,80,000	80,000	3,40,000
Total costs	5,60,000	4,50,000	6,20,000	16,30,000
Profit (Loss)	1,20,000	(60,000)	1,00,000	1,60,000

**Joint cost calculation*

Input of raw material (1,00,000 × Rs. 4)	Rs. 4,00,000
Processing cost [1,00,000 × (Rs. 12 ÷ 10)]	1,20,000

Total joint costs	5,20,000
-------------------	----------

Less : Net realisable value of by-product *D*

(For output 10 kg of input, only 1 kg of *D* is obtained.

The production of *D* out of 1,00,000 of raw material will be $1,00,000 \times (1 \div 10)$

20,000

Joint costs

5,00,000

It is given in the question that the net costs of joint process are allocated in proportion of contribution. The allocation of joint costs will be as under :

<i>Product</i>	<i>Total output</i>	<i>Contribution per kg.</i>	<i>Total contribution</i>	<i>Allocated joint costs</i>
<i>A</i>	40,000 kg	Rs. 10	Rs. 4,00,000	Rs. 2,00,000
<i>B</i>	30,000	8	2,40,000	1,20,000
<i>C</i>	20,000	18	3,60,000	1,80,000
			10,00,000	5,00,000

Calculation of overhead recovery rate on machine hour/labour hour basis

Product	Total output	Machine hours		Labour hour	
		Per kg.	Total	Per kg.	Total
A	40,000 kg.	2	80,000	1	40,000
B	30,000	6	1,80,000	1	30,000
C	20,000	4	80,000	5	1,00,000
			3,40,000		1,70,000

Machine hour rate = Rs. $3,40,000 \div 3,40,000$ or Rs. 1.00 per hour

Labour hour rate = Rs. $3,40,000 \div 1,70,000$ or Rs. 2 per hours.

When fixed overheads are allocated on the basis of direct labour hours

	A	B	C	Total
	Rs.	Rs.	Rs.	Rs.
Sales	6,80,000	3,93,000	7,20,000	17,90,000
Less : Joint costs, labour costs and other costs as per (b) above	4,80,000	2,70,000	5,40,000	12,90,000
	2,00,000	1,20,000	1,80,000	5,00,000
Less : fixed overhead apportion on D.L.H. basis	80,000	60,000	2,00,000	3,40,000
Profit (Loss)	1,20,000	63,000	(20,000)	1,60,000

Profitability of Further Processing vs Selling at Split-off point

Problem 8-10. A chemical factory processes raw material *R* and produces three similar products *P*₁, *P*₂ and *P*₃ out of a joint process. The joint cost of processing 5,000 kg of *R* are as under :

Labour cost	Rs. 6,000
Overhead Cost	2,000
Total	8,000

The raw material *R* is purchased at Rs. 2.40 per kg. This rate is after a trade discount of 20% on list price. Normal loss is estimated at 10% of input weight. The scrap generated from processing *R* is recovered to the extent of 25% (by weight) and sold as such in the

market at Rs. 4 per kg. The products P_1 , P_2 , P_3 can be sold at Rs. 5'00, Rs. 6'00 and Rs. 6'50 per kg respectively without any further processing.

However, products P_1 and P_2 can also be further jointly processed at an additional cost of Rs. 2 per kg of input to get product J_1 . The further processing cost of J_1 will be Re 1 per kg of output weight.

Similarly, products P_2 and P_3 can be jointly processed to get a product J_2 at an additional cost of Rs 5 per kg of input. The further processing cost of J_2 will be Rs 2 per kg of output weight. The normal loss of processing J_1 out of P_1 and P_2 will be 5% of output weight. No processing loss is expected on processing J_2 . The selling prices of J_1 and J_2 including the input composition is given below :

Input		<i>J₁</i>	<i>J₂</i>
P_1		40%	
P_2		60%	50%
P_3			50%
Price per kg	Rs.	10'00	12'00

The output weights of P_1 , P_2 and P_3 will be in the proportion of 3 : 4 : 2.

Required to :

(a) Show profitability of processing P_1 , P_2 and P_3 from 5,000 kg. of R assuming the sale at split-off point.

(b) Profitability after both J_1 and J_2 are further processed and marketed using P_3 in the ratio of 3 : 2 for J_1 and J_2 respectively.

(c) Recommend the processing decision among the alternatives i.e. to use whole output of P_3 for processing J_1 or J_2 to yield maximum profit and the amount of such maximum profit. (I.C.W.A. Final, Dec. 1986).

Solution :

(i) Joint Cost

5000 kg. \times Rs. 2'40	Rs. 12,000
Labour cost	6,000
Overhead cost	2,000
Total	Rs. 20,000

(ii) Input weight	5,000 kg.
Normal loss 10%	500 kg.
	<u>4,500 kg.</u>

- (iii) Normal loss 500 kg.
 25% of it sold 125 kg.
 Realisation from scrap
 @ Rs. 4.00 per kg. Rs. 500
- (iv) Net cost of input or joint cost to be apportioned Rs. 20,000 – Rs. 500 = Rs. 19,500
- (v) Output for joint processing :

	Output in kg.
$P_1 (4,500 \times 3/9)$	1,500 kg.
$P_2 (4,500 \times 4/9)$	2,000 kg.
$P_3 (4,500 \times 2/9)$	1,000 kg.
Total weight	4,500

- (vi) Sales realisation if output is sold at split-off point

P_1 1,500 kg.	@	Rs. 5.00	=	Rs. 7,500
P_2 2,000 kg.	@	Rs. 6.00	=	Rs. 12,000
P_3 1,000 kg.	@	Rs. 6.50	=	Rs. 6,500
Total				26,000

- (vii) Allocation of joint processing cost

(There are different methods for apportioning the cost up to the point of separation among joint products. It is presumed that Joint Cost is apportioned among joint products in the ratio of sales realisation at the split off point.)

P_1	(Rs. 19,500 × 7,500) ÷ 26,000	=	Rs. 5,625
P_2	(Rs. 19,500 × 12,000) ÷ 26,000	=	Rs. 9,000
P_3	(Rs. 19,500 × 6,500) ÷ 26,000	=	Rs. 4,875

Total Joint Cost	19,500
------------------	--------

- (a) Profitability of processing assuming the sale at split-off point

Output	Allocated Cost	Selling price	Profit	Profit per kg
P_1 1,500	Rs. 5,625	Rs. 7,500	Rs. 1,875	Rs. 1.25
P_2 2,000	Rs. 9,000	Rs. 12,000	3,000	1.50
P_3 1,000	Rs. 4,875	Rs. 6,500	1,625	1.625
			6,500	

- (b) For this alternative P_3 is to be used in the ratio of 3 : 2 i.e. 1,200 kg of P_3 will be used for J_1 and 800 kg of P_3 will be used for J_2

(i) For J_1		
1,200 kg of P_2	$(9,000 \times 1,200) \div 2,000$	Rs. 5,400
800 kg of P_1	$(800 \times 5,625) \div 1,500$	Rs. 3,000
		<hr/> 8,400
Joint processing Cost of $P_1 P_2$ and $2,000 \times$ Rs. 2		4,000
Additional Processing for J_1 $1,900 \times 1$		1,900
		<hr/> 14,300
From Sale of J_1		19,000
		<hr/>
Profit (Sale—Cost) (Rs. 19,000—Rs. 14,300)		4,700

(ii) For J_2		
800 kg of P_2	$(800 \times 9,000) \div 2,000$	3,600
800 kg of P_3	$(800 \times 4,825) \div 1,000$	3,900
		<hr/> 7,500
1600 kg.		<hr/>
Joint processing Cost of P_2 and P_3 (1600×5)		8,000
Additional processing for J_2 (1600×2)		3,200
		<hr/> 18,700
Total Cost for input of J_2		18,700
Sale of J_2 $(1,600 \times 12)$		19,200
		<hr/>
Profit on Sale of J_2	(Rs. 19,200—Rs. 18,700)	500

(iii) Cost of Balance of P_1 i.e. 700 kg		
	$(700 \times 5,625) \div 1,500$	2,625
Sales value of 700 kg. of P_1	$(700 \text{ kg.} \times \text{Rs. } 5)$	3,500
		<hr/>
Profit from sale of 700 kg. of P_1		
(Rs. 3,500—Rs. 2,625)		Rs. 875

(iv) Cost of Balance of P_3 i.e. 200 kg		
	$(200 \times 4,875) \div 1,000$	Rs. 975
Sales value of 200 kg. of P_3	$(200 \text{ kg.} \times \text{Rs. } 6.5)$	1,300
		<hr/>
Profit from sale of 200 kg. of P_3		
(Rs. 1,300—Rs. 975)		Rs. 325

Total profit under alternative

(b) i.e., (i) + (ii) + (iii) + (iv)

or Rs. 4,700 + Rs. 500 + Rs. 875 + Rs. 325 = Rs. 6,400

(c) From alternative (b), profit for J_1 and J_2 for per kg material of P_2 is as follows :

For J_1 Rs. $4,700 \div 1,200 =$ Rs. 917 per kg. of P_2 .

For J_2 Rs. $500 \div 800 = \text{Rs. } 0.625$ per kg. of P_2 .

\therefore It is beneficial to produce maximum unit of J_1 by processing P_2 .

(i) \therefore For J_1

Cost of 2,000 kg. of P_2	Rs. 9,000.00
	<u>4,998.75</u>
Cost of 1,333 kg. of P_1 , i.e., 40% of mixture	13,998.75
Joint Processing Cost of P_1 and P_2 (3,333 \times Rs. 2)	<u>6,666.00</u>
	20,646.75
Additional processing cost of J_1 (3,333 \times 0.95 \times Rs. 1)	<u>3,166.35</u>
	23,811.10
Sale value of J_1	<u>31,663.50</u>
Profit on J_1 (Rs. 31,663.50—Rs. 23,811.10)	= Rs. 7,832.40
(ii) Cost of Balance of P_1 (167 \times 5625) \div 1,500	Rs. 625.25
Sale value of balance of P_1 (167 \times 5)	<u>835.00</u>
Profit on sale of P_1	208.75
(iii) Cost of P_2	Rs. 4,875
Sale of P_2 (Rs. 1,000 \times Rs. 6.50)	<u>6,500</u>
Profit on P_2 (Rs. 6,500—Rs. 4,875)	Rs. 1,625

Total Profit under alternative (c)

Rs. 7,832.40 + Rs. 208.75 + Rs. 1,625.00 = Rs. 9,666.15

Process further or introduce a new raw material

Problem 8 11. A company's plant processes 6,00,000 kg. of raw material in a month to produce two products, viz., Alex and Ballex. The cost of raw materials is Rs. 3.00 per kg. The process costs per month are :

Direct materials	Rs. 90,000
Direct wages	Rs. 1,20,000
Variable overheads	Rs. 1,00,000
Fixed overheads	Rs. 1,00,000

The loss in process is 5% of input and the output ratio of Alex and Ballex which emerge simultaneously is 1 : 2. The selling prices of the two products at the point of split-off are : Alex Rs. 3 per kg. and Ballex Rs. 5 per kg.

A proposal is available to process Alex further by mixing it with other purchased materials. The entire current output of the factory can be so processed further to obtain a new product SA. The price per kg. of

SA is Rs. 3.75 and each kg. of output of *SA* will require one kg. of input of *Allex*. The cost of processing of *Allex* into *SA* including other materials is Rs. 1,85,000 per month.

Alternatively, another proposal available is to introduce a new raw material for the manufacture of *Allex* and *Ballex*. The new raw material will bring down the process loss to 4% and change the output mix of *Allex* and *Ballex* to 2 : 3. The company's capacity to process the new raw material is also 6,00,000 kg. per month. The cost of new raw material is Rs. 2.90 per kg. All other costs will remain the same.

Required :

- (i) Present a statement showing the monthly profitability based on the existing manufacturing operations.
- (ii) Evaluate the two proposals independently and present statements showing the respective monthly profitability.

(I.C.W.A. Final, June 1987)

Solution (i) Statement showing the monthly profitability based on existing manufacturing operations

	<i>Allex</i>	<i>Ballex</i>	Total
Sales volume* (kg.)	1,90,000	3,80,000	5,70,000
Selling price per kg.	Rs. 3	Rs. 5	
Sales value	Rs. 5,70,000	Rs. 19,00,000	Rs. 24,70,000
Less : Joint costs @	5,10,000	17,00,000	22,10,000
Existing profit	60,000	2,00,000	2,60,000

(ii) (a) Proposal I--Processing *Allex* into *SA*

Cost of <i>Allex</i>	Rs. 5,10,000
Additional cost for <i>SA</i>	1,85,000
Total cost of <i>SA</i>	6,95,000
Sales of <i>SA</i> (1,90,000 × 3.75)	7,12,500
Profit of <i>SA</i>	17,500
Add : Profit of <i>Ballex</i> [as at (i) above]	2,00,000
Total profit under this proposal	2,17,500

*Materials	6,00,000 kg.
Less : 5% loss	30,000
Total output	5,70,000

Allex's output $5,70,000 \times 1/3 = 1,90,000$ kg.

Ballex output $5,70,000 \times 2/3 = 3,80,000$ kg.

@ Total joint cost (Rs. 18,00,000 + 90,000 + 1,20,000 + 1,00,000 + 1,00,000) = Rs. 22,10,000 be distributed between *Allex* and *Ballex* in the ratio of sales value.

(b) Proposal II—Introducing a new raw material

Input of new raw material	6,00,000 kg.
Less : Process loss (4%)	24,000

Total output	5,76,000
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	<i>Allex</i>	<i>Ballex</i>	<i>Total</i>
Sales volume (kg.)			
(Ratio 2 : 3)	2,30,400	3,45,600	5,76,000
Selling price per kg.	Rs. 3.00	Rs. 5.00	
Sales value	Rs. 6,91,200	Rs. 17,28,000	Rs. 24,19,200
Less : Joint Cost	6,14,286	15,35,714	21,50,000
Profit	76,914	1,92,286	2,69,200

Total joint costs (Rs. 17,40,000 + 90,000 + 1,20,000 + Rs. 1,00,000 + Rs. 1,00,000) = Rs. 21,50,000 to be distributed between Allex and Ballex in the ratio of sales value.

Comments. Proposal II should be accepted as it improves the overall profit by Rs. 9,200. The recommendation assumes that the proposals will not affect the acceptability of the products in the market.

Selling after final completion or at Split-off point

Problem 8.12. Progressive Process Industries manufactures two products *P* and *Q*. Under present operations, raw materials are processed in Department *A* and the two products are separated at the end of this process. For every unit of *P*, two units of *Q* are obtained. *P* is then finished in Dept. *B* and *Q* in Dept. *C*. Actual operating data for 1984 are as under :—

	<i>Dept. A</i>	<i>Dept. B</i>	<i>Dept. C</i>	<i>Total</i>
Units produced				
<i>P</i>	40,000	40,000		40,000
<i>Q</i>	80,000		80,000	80,000
Cost incurred (Rs.) :				
Raw Material	1,20,000			1,20,000
Direct Labour	70,000	50,000	60,000	1,80,000
Variable Overheads	40,000	20,000	20,000	80,000
Avoidable fixed Overheads	20,000	10,000	10,000	40,000
Common fixed Overheads allocated on basis of floor space.	50,000	25,000	25,000	1,00,000

At present *P* is sold for Rs. 6.25 and *Q* for Rs. 4 per unit. Both products are also readily marketable at the completion of processing in Department *A*—*P* for Rs. 4.50 per unit and *Q* for Rs. 2.75 per unit. Department *B* and/or Department *C* could be closed down completely if *P* and/or *Q*, respectively were sold at the split-off point.

- (a) Under an absorption Costing System, what would be the average unit cost of *P* and of *Q* during 1984?
- (b) From the point of view of short-run profit maximization, when should each product be sold during 1984—after final completion or at the split-off point? (*I.C.W.A. Final, December 1984*)

Solution (a) Joint Cost of Deptt. *A* for Rs. 3,00,000 should be apportioned based on Sales value of Products *P* and *Q*.

Sale value at split off point :

	Rs.
<i>P</i> 40,000 × Rs. 4.50	1,80,000
<i>Q</i> 80,000 × Rs. 2.75	2,20,000
	<hr/> 4,00,000

	<i>P</i>	<i>Q</i>	Total
Joint Cost (Distributed in ratio of 18 : 22)	Rs. 1,35,000	Rs. 1,65,000	Rs. 3,00,000
Further processing cost (Dep't. <i>B</i>)	1,05,000	1,15,000	2,20,000
	<hr/> 2,40,000	<hr/> 2,80,000	<hr/> 5,20,000
Total Cost			
Units produced	40,000	80,000	
Cost per unit	Rs. 6	Rs. 3.5	

Profit after further processing :

	<i>P</i>	<i>Q</i>	Total
(b) Sale in units	40,000	80,000	
Selling price per unit after processing	Rs. 6.25	Rs. 4.00	
Total Sales value	Rs. 2,50,000	Rs. 3,20,000	Rs. 5,70,000
Less : Total Cost	2,40,000	2,80,000	5,20,000
	<hr/> 10,000	<hr/> 40,000	<hr/> 50,000
Profit			

Profit without further processing :

Sales Value at split-off point

P—40,000 × Rs. 4.50 = Rs. 1,80,000

Q—80,000 × 2.75 = Rs. 2,20,000

4,00,000

<i>Less : Joint Cost of A</i> Rs. 3,00,000			
<i>Common fixed Cost of B & C</i>			
	50,000	3,50,000	
Profit		50,000	
	<i>P</i>	<i>Q</i>	Total
Incremental Revenue from further processes			
40,000 × (6.25—4.50)	Rs. 70,000	Rs. 1,00,000 }	Rs. 1,70,000
80,000 × (4.00—2.75)			
<i>Less : Incremental Cost</i>			
Deptt B's Cost	80,000		1,70,000
Deptt C's Cost		90,000	
Incremental profit/(loss)	(10,000)	10,000	—

P should be sold at split-off point and *Q* should be sold after processing in Deptt C. If this proposal is accepted, profit position will be as follows :

Sales : <i>P</i> at Split-off point	Rs. 1,80,000
<i>Q</i> after processing	3,20,000
	<u>5,00,000</u>
<i>Less : Joint Cost</i>	Rs. 3,00,000
Further processing of <i>Q</i>	1,15,000
Common fixed Cost	Rs. 25,000
	<u>4,40,000</u>
Profit	<u>60,000</u>

MISCELLANEOUS

Computing the purchase price of raw material

Problem 8-13. Premier Processing Factory carries out 10 batches of production in a year, with 1000 kg. of raw material *M* per batch of production and after processing recovers 5 joint products *A*, *B*, *C* and *D* and a gas *G*. The following details are available :

Plant and machinery (net)	Rs. 80,000
Land and Buildings	40,000
Others	30,000
Cash, Stock and Debtors	70,000
Current liabilities	20,000

<i>Product</i>	<i>Production (Per 1000 kg of M)</i>	<i>Unit Selling Price</i>
<i>A</i>	500 kg.	Rs. 30
<i>B</i>	200	25
<i>C</i>	100	40
<i>D</i>	300	15
<i>G</i>	2,500 litres	2

Processing cost (conversion cost) is estimated at Rs. 6,410 per batch, material handling charges at Rs. 680 per 1,000 kg. of *M* and selling and distribution expenses [at 10% of sales. The factory works on 10% return on investment.

One per cent of raw material is retrieved at the end of the process at original cost (without handling charges) and is used for next batch of production. The balance of raw material unaccounted for is invisible waste.

Work out the purchase price per kg. of *M* in order to achieve the above result and compute the unit cost of sales of each of the joint products based on their sales value. (I.C.W.A. Final, Dec. 1982)

Solution. For working out the per kg. cost of raw material, it is necessary to compute the sales per annum and profit margin, which is 10% on investments. For this reason, the amount of investments should first be determined :

1. Computation of Investment

(a) Fixed Assets

Plant and machinery	Rs. 80,000
Land and building	40,000
Other assets	30,000
Total fixed Assets	1,50,000

(b) Working Capital

Cash, stock and debtors	70,000
<i>Less</i> : Current liabilities	20,000
Net working capital	50,000
Total investments (a ÷ b)	2,00,000
Profit @ 10% of investments	20,000

2. Computation of Sales Value per annum

<i>Product</i>	<i>Unit</i>	<i>Production per annum (per 10 batches)</i>	<i>Sales price per unit</i>	<i>Total sales value p.a.</i>
<i>A</i>	kg.	500	Rs. 30·00	Rs. 15,000
<i>B</i>	„	2,000	25·00	50,000
<i>C</i>	„	1,000	40·00	40,000
<i>D</i>	„	3,000	15·00	45,000
<i>G</i>	litre	25,000	2·00	50,000
Total				2,00,000 =====

3. Computation showing the purchase price per kg. of raw material *M*

Sales value per annum (as at 2 above)	Rs. 2,00,000
Less : Profit (as at 1 above)	20,000
Cost of sales	1,80,000
Less : Selling and distribution charges (10% of sales)	20,000
Cost of production	1,60,000
Less : Conversion costs (Rs. 6410 × 10)	64,100
Factory cost	95,900
Less : Material handling	6,800
Cost of 9,900 kg. of material <i>M</i>	89,100
Cost of 1 kg. of Material <i>M</i> (89,100 ÷ 9900)	= Rs. 9 per kg.

4. Computation of unit cost of sales of joint product

Product	Unit	Production	Unit sales value per annum (as per table 2)	Profit 10% of sales or investment	Cost of sales	Cost of sales per unit
A	kg.	500	Rs. 15,000	Rs. 1,500	Rs. 13,500	Rs. 27.00
B	„	2,000	50,000	5,000	45,000	22.50
C	„	1,000	40,000	4,000	36,000	36.00
D	„	3,000	45,000	4,500	40,500	13.50
G	Ltr.	25,000	50,000	5,000	45,000	1.80

Problem 8-14 (Joint Product and By-product) A distillation plant, which works continuously, process 1,000 tonnes of raw material each day. The raw material costs Rs. 4 per tonne and the plant operating costs per day are Rs. 2,600. From the input of raw material the following output is produced :

	%
Distillate X	40
Distillate Y	30
Distillate Z	20
By-product B	10

From the initial distillation process, Distillate X passes through a heat process which costs Rs. 1,500 per day and becomes Product X which requires blending before sale.

Distillate Y goes through a second distillation process costing Rs. 3,300 per day and produces 75% of Product Y and 25% of Product X₁.

Distillate Z has a second distillation process costing Rs. 2,400 per day and produces 60% of Product Z and 40% of Product X₁.

The three streams of Products X, X₁ and X₂ are blended, at a cost of Rs. 1,155 per day to become the saleable final product XXX.

There is no loss of material from any of the processes.

By-product B is sold for Rs. 3 per tonne and such proceeds are credited to the process from which the by-product is derived.

Joint costs are apportioned on a physical unit basis.

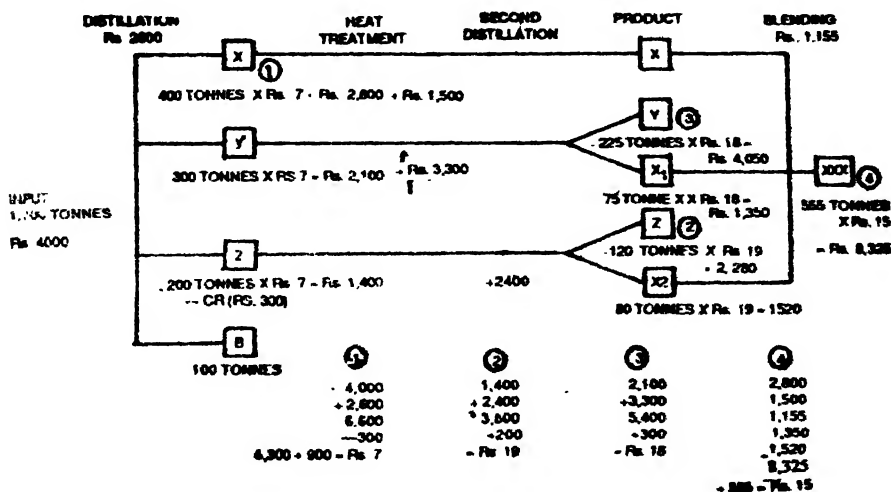
You are required to : (a) draw a flow chart, flowing from left to right, to show for one day of production the flow of material and the build-up of the operating costs for each product.

(b) present a statement for management showing for *each* of the products XXX, Y and Z, the output for one day, the total cost and the unit cost per tonne.

(c) suggest an alternative method for the treatment of the income receivable for by-product B than that followed in this question (figures are not required).

(C.I.M.A. London. May 1987)

Solution. (a)



(b) *Product Y*

Direct materials
Distillation costs

300 units

Rs. 2,100

3,300

5,400

1,350

4,050

Less : Cost of X₁

Cost per unit Rs. 18

Product Z

Direct materials 200 units
Distillation costs

1,400

2,400

3,800

1,520

2,280

Less : Cost of X₂

Cost per unit Rs. 19

Product XXX

Distillation X	400 units	4,300
X_1	75	1,350
X_2	80	1,520
	<hr/>	<hr/>
	555	7,170
Add : Blending cost		1,155
		<hr/>
		8,325
		<hr/>

Cost per unit Rs. 15.

(c) Alternatively, the income receivable for by-product B can also be shown as miscellaneous income in profit and loss account.

**BREAK-UP OF THE PROBLEMS RELATING TO JOINT
PRODUCTS AND BY-PRODUCTS ACCORDING TO
DIFFERENT LEVELS (FOR PROBLEMS WITH
PREFIX A, REFER TO APPENDIX A)**

Intermediate Level

Apportionment—P8-1, 8-2, 8-4, 8-8, A7, A48, A80, A114, A135, A150

Miscellaneous—P 8-14.

Final Level

Apportionment—P 8-5, 8-6, 8-7, 8-9, 8-10, 8-11, 8-12

Miscellaneous—P 8-3, 8-13, A 75

Please also refer to the Examples 9-1 to 9-16 of the book "Advanced Cost and Management Accounting—Text" by Saxena and Vashist.

Marginal Costing and Cost-Volume-Profit Relationship

[Steps for solving marginal costing problems — Break-even Analysis 9'1-9'23 — Break-even Charts 9'24-9'26 — Key Factors 9'27 — 9'33 — Effect of Change in Cost, volume and price 9'34-9'45 — Determination of suitable product mix 9'46-9'59 — Merging the two plants 9'60-9'62 — Absorption Costing Vs. Marginal Costing 9'63-9'66.]

Steps to be kept in mind for solution of problems relating to this Chapter.

1. Variations of Basic Marginal Cost Equation

$$1'1. S - V = F + P$$

By multiplying and dividing L.H.S. by S

$$1'2. \frac{S(S - V)}{S} = F + P$$

$$1'3. S \times P/V \text{ Ratio} = F + P \quad \left(\because P/V \text{ Ratio} = \frac{S - V}{S} \right)$$

$$1'4. BES \times P/V \text{ Ratio} = F \quad (\because \text{at BEP profit is zero})$$

$$1'5. BES = \frac{F}{P/V \text{ Ratio}}$$

$$1'6. P/V \text{ Ratio} = \frac{F}{BES}$$

$$1'7. S \times P/V \text{ Ratio} = \text{Contribution (Refer to 1'3)}$$

$$1'8. P/V \text{ Ratio} = \frac{\text{Contribution}}{\text{Sales}}$$

$$1'9. (BES + MS) \times P/V \text{ Ratio} = \text{Contribution} \quad (\because \text{total sales} = BES + MS)$$

$$1'10. (BES \times P/V \text{ Ratio}) + (MS \times P/V \text{ Ratio}) = F + P.$$

By deducting $(BES \times P/V \text{ Ratio})$ from L.H.S. and F from R.H.S. in 1'10, we get :

$$1'11. MS \times P/V \text{ Ratio} = P.$$

$$2'1. P/V \text{ Ratio} = \frac{\text{Change in profit}}{\text{Change in sales}}$$

$$3'1. P/V \text{ Ratio} = \frac{\text{Change in contribution}}{\text{Change in sales}}$$

$$4.1. \text{ Profitability} = \frac{\text{Contribution}}{\text{Key factor}}$$

$$5.1. \text{ Margin of Safety} = \text{Total sales} - \text{BES}$$

$$6.1. \text{ BES} = \text{Total sales} - \text{MS}$$

$$7.1. \text{ Margin of safety ratio} = \frac{\text{Total sales} - \text{BES}}{\text{Total sales}}$$

*These steps have been frequently referred to in the solutions.**

BREAK-EVEN ANALYSIS

Overall B.E. Point

Problem 91. A Ltd. manufactures and sells four types of products under the brand names P, Q, R and S. The sales mix in value comprises 33-1/3%, 41-2/3%, 16-2/3% and 8-1/3% of P, Q, R and S respectively. The total budgeted sales (100%) are Rs. 60,000 per month.

Operating costs are :

Variable Costs :

Product P	—60% of selling price		
„ Q	—68%	„	„
„ R	—80%	„	„
„ S	—40%	„	„

Fixed Cost : Rs. 14,700 per month.

Calculate the break-even point for the products on an overall basis, i.e., in total. (C.S. Final, June 1987)

Solution :

	Products				Total
	P	Q	R	S	
	33½%	41½%	16½%	8½%	
Sales Value	Rs. 20,000	Rs. 25,000	Rs. 10,000	Rs. 5,000	Rs. 60,000
Variable Costs (Based on given %)	12,000	17,000	8,000	2,000	39,000
Contribution	8,000	8,000	2,000	3,000	21,000
Fixed Cost					14,700
Profit					6,300

Break-even Point for the Products on Overall Basis :

$$\text{B.E. Sales} = \text{Fixed Cost} \div \text{P/V ratio} = \text{Rs. } 14,700 \div 0.35 = \text{Rs. } 42,000.$$

*For abbreviations, refer to Cost and Management Accounting—Text by Saxena & Vashist.

Maximising Total Profit with two Limiting Factors

Problem 9.2. As a part of its rural upliftment programme, the Government has put under cultivation a farm of 96 hectares to grow tomatoes of four varieties : Royal Red, Golden Yellow, Juicy Crimson and Sunny Scarlet. Of the total 68 hectares are suitable for all four varieties, but the remaining 28 hectares are suitable for growing only Golden Yellow and Juicy Crimson. Labour is available for all kinds of farm work and there is no constraint.

The market requirement is that all four varieties of tomatoes must be produced with a minimum of 1,000 boxes of any one variety.

The farmers engaged have decided that the area devoted to any crop should be in terms of complete hectares and not in fractions of a hectare. The other limitation is that not more than 22,750 boxes of any one variety should be produced. The following data are relevant.

Varieties	Royal Red	Golden Yellow	Juicy Crimson	Sunny Scarlet
<i>Annual Yield</i>				
Boxes per hectare	350	100	70	180
<i>Costs</i>	Rs.	Rs.	Rs.	Rs.
Direct :				
Materials per hectare	476	216	196	312
Labour :				
Growing per hectare	896	608	371	528
Harvesting and				
packing per box	3.60	3.28 ¹	4.40	5.20
Transport per box	5.20	5.20	4.00	9.60
Market price				
per box	15.38	15.87	18.38	22.27
Fixed overheads per annum				
Growing				Rs. 11,200
Harvesting				7,400
Transport				7,200
General Administration				10,200

Find out : (i) Within the given constraints, the area to be cultivated with each variety of tomatoes, if the largest total profit has to be achieved. (ii) The amount of such profit in rupees.

A nationalised bank has come forward to help in the improvement programme of the 28 hectares in which only Golden Yellow and Juicy Crimson will grow, with a loan of Rs. 5,000 at a very nominal interest of 6% per annum. When this improvement is carried out, there will be a saving of Rs. 1.25 per box in the harvesting cost of Golden Yellow and the 28 hectares will become suitable for growing Royal Red in addition to the existing Golden Yellow and Juicy Crimson varieties. Assuming that other constraints continue, find the maximum total profit that would be achieved when the improvement programme is carried out.

(C.A. Final, Nov., 1988 ; CIMA London, Nov. 87—Adapted ;
I.C.W.A Inter, Dec. 1978 Similar)

Solution. Statement showing the contribution per hectare of each variety of tomatoes

	<i>Royal Red</i>	<i>Golden Yellow</i>	<i>Juicy Crimson</i>	<i>Sunny Scarlet</i>
Boxes per hectare	350	100	70	180
				(Per Box)
(a) Market Price per box	Rs. 15.38	Rs. 15.87	Rs. 18.38	Rs. 22.27
Variable Costs				
Direct Materials	1.36*	2.16	2.80	1.73
Labour (Growing)	2.56	6.08	5.30	2.94
Harvesting and packing	3.60	3.28	4.40	5.20
Transport	5.20	5.20	4.00	9.60
(b) Total Variable Costs	12.72	16.72	16.50	19.47
(c) Contribution per box (a - b)	2.66	(0.85)	1.88	2.80
Contribution per hectare				
(c) × Boxes per hectare	931	(85)	131.60	504
Ranking	I	IV	III	II

Therefore, production of Golden Yellow should be restricted to 1,000 boxes (minimum) or 10 hectares of farm should be used for this variety. Thus, the balance 16 hectares should be used for Juicy Crimson.

*Material cost per hectare : Boxes per hectare

(i) Area to be cultivated for each variety and total contribution

	<i>Hectare</i>	<i>Contribution per Hectare</i>	<i>Total Contribution</i>
Golden Yellow	10	(85)	(850)
Juicy Crimson	18	131.60	2368.80
Sunny Scarlet	6	504.00	3024.00
Royal Red (Maximum) but restricted to balance	62	931.00	57,720.00
	96		62,264.80
Less : Fixed Costs	—		6,000.00
Optimum profit			26,264.80

@ Minimum 1000 boxes ÷ 18 = 5.6 or 6 hectare

Maximum total profit with improvement programme

Golden Yellow's contribution per box	Rs. 0.85
Saving in variable cost	+ 1.25
Additional contribution per box	0.40
Additional contribution per hectare = 0.40 × 100 =	Rs. 40

With this improvement, 28 hectares will also become suitable for Royal Red. Thus other three varieties should be produced to minimum extent and the profit after improvement will be :

	<i>Hectare</i>	<i>Boxes</i>	<i>Contribution per hectare</i>	<i>Total Contribution</i>
Golden Yellow	10*	1,000	Rs. 40.00	Rs. 400
Juicy Crimson	15*	1,050	131.60	1,974
Sunny Scarlet	6*	1,050	504.00	3,024
Royal Red (Maximum)	65	21,700	931.00	60,515
	96			65,913

Less : Fixed Cost (Rs. 36,000 + Rs. 300 bank interest) 36,300

Maximum profit 29,613

*Minimum and rounded off

Break-even Volume of Two Machines or Cost Indifference Point

Problem 9.3. Sturdy Horse Ltd., a cycle manufacturing company, has drawn up a programme for the manufacture of a new product for the purpose of fuller utilisation of its capacity. The scheme envisages the manufacture of baby tricycle fitted with a bell. The company estimates the sales of tricycles at 10,000 during the first year and expects that from the second year onwards the sales estimates will stabilise at 20,000 tricycles. Since the company has no provision for the manufacture of the small bells specially required for the tricycles, the requirement of the bells is initially proposed to be met by way of purchase from the market at Rs. 8 each. However, if the company desires to manufacture the bell in its factory by installation of new equipment, it has two alternative proposals as under :

	<i>Installation of Super-X Machine</i>	<i>Installation of Janta Machine</i>
Initial Cost of machine	Rs. 3,00,000	Rs. 2,00,000
Life	10 years	10 years
Fixed overheads other than depreciation on machines (per annum)	Rs. 54,000	Rs. 28,000
Variable expenses per bell	Rs. 4.00	Rs. 5.00

Depreciation on machine should be charged on straight line basis.

Required :

- For each of the two levels of output namely 10,000 and 20,000 bells state with suitable workings whether the company should purchase the bells from market or install new equipment for manufacture of bells. If your decision is in favour of the installation of new equipment, which of the two new machines should be installed?
- What would be your decision in case the forecast of requirement from the second year onwards is estimated at 40,000 bells instead of 20,000 bells.
- At what volume of bells will the installation of the two machines break-even.
(I.C.W.A. Final, June 1987)

Solution :**(i) Cost-Benefit Analysis of Two Machines at Output Level of 10,000 and 20,000 Units**

Output Details	10,000 units		20,000 units	
	Super-X	Janata	Super-X	Janata
Cost of Buying	Rs.	Rs.	Rs.	Rs.
@ Rs. 8 from Market	80,000	80,000	1,60,000	1,60,000
Cost of Manufacturing				
Variable Cost	40,000	50,000	80,000	1,00,000
Depreciation on Machine	30,000	20,000	30,000	20,000
Fixed Overhead	54,000	28,000	54,000	28,000
Total Cost	1,24,000	98,000	1,64,000	1,48,000
Decision	Buy from Market		Install Janata Machine	

(ii) Buy/Manufacture Decision at Level of 40,000 Units

	Super-X	Janata
Cost of Buying @ Rs. 8	Rs. 3,20,000	Rs. 3,20,000
Manufacturing Cost		
Variable Cost	1,60,000	2,00,000
Depreciation on Machinery	30,000	20,000
Fixed Overhead	54,000	28,000
Total Cost of Manufacture	2,44,000	2,48,000
Cost Saving on Manufacture	76,000	72,000

Decision. As Super-X, Machine results in higher cost saving, it should be installed at an ensured volume of 40,000 units.

(iii) Break-Even Volume of Two Machines

It is that volume of production at which a manufacturer is indifferent as to which machine he should install as total cost on both machine is the same. This point is known as cost indifference point.

Let Break-even volume

= x units.

Cost on Super X Machine for x units = $54,000 + 30,000 + 4x$

= $84,000 + 4x$

...(1)

$$\begin{aligned}\text{Cost on Janata M/c for 'x' units} &= 20,000 + 28,000 + 5x \\ &= 48,000 + 5x \quad \dots (2)\end{aligned}$$

At cost indifference point, total cost under two alternatives will be equal. Therefore,

$$\therefore 84,000 + 4x = 48,000 + 5x \quad \text{or} \quad x = 36,000 \text{ units.}$$

So at 36,000 units, the installation of the two machines will break-even.

Sales Mix Required to Earn a Target Profit

Problem 9.4. The following set of information is presented to you by your client *AB Ltd.* producing two products *X* and *Y*

	<i>X</i>	<i>Y</i>
	Rs.	Rs.
1. Direct materials per unit	20	18
2. Direct wages (per unit)	6	4
3. Fixed overhead during the period is expected to be Rs. 1,600.		
4. Variable overhead is allocated to products at the rate of 100% of direct wages.		
	Rs.	Rs.
5. Sales price per unit	40	30
6. Proposed sales mix :		
(i) 100 units of <i>X</i> and 200 units of <i>Y</i>		
(ii) 150 units of <i>X</i> and 150 units of <i>Y</i> .		
(iii) 200 units of <i>X</i> and 100 units of <i>Y</i> .		

As a Cost Accountant you are requested to present to the management of *AB Ltd.* the following :

- The unit marginal cost and unit contribution
- The total contribution and the resultant profit from each of the above sales mixes.
- The proposed sales mixes to earn a profit of Rs. 300 and Rs. 600 with the total sales of *X* and *Y* being 300 units.

[I.C.M.A. Inter (N.S.), Dec. 1984]

Solution :

(a) Statement showing the Unit Marginal Cost and Unit Contribution

	Product	
	<i>X</i>	<i>Y</i>
Selling price	Rs. 40	Rs. 30

Marginal Cost

Direct material	20	18
Direct wages	6	4
Variable overhead	6	4
	<hr/>	<hr/>
Total	32	26
	<hr/>	<hr/>
Contribution	8	4
	<hr/>	<hr/>

(b) Statement showing the Profitability of Various Sales Mixes

	(i)			(ii)			(iii)		
	<i>X</i>	<i>Y</i>	Total	<i>X</i>	<i>Y</i>	Total	<i>X</i>	<i>Y</i>	Total
Sales mix (units)	100	200	300	150	150	300	200	100	300
Contribution Total (Rs.)	800	800	1,600	1,200	600	1,800	1,600	400	2,000
Less : Fixed overhead			1,600			1,600			1,600
Profit						200			400
(c)						Case I			Case II
Required profit (Rs.)						300			600
Add : Fixed overhead						1,600			1,600
Total contribution						1,900			2,200

Case I

Suppose number of *X* units to be sold = p

Then, number of *Y* units will be sold = $(300 - p)$

Equating $8p + 4(300 - p) = 1,900$

or $8p + 1,200 - 4p = 1,900$ or $p = 175$.

Proposed mix *X* = 175 units

Y = 125 units

300 units

Case II

Suppose number of *X* units to be sold = q

The number of *Y* units will be $(300 - q)$

$$\begin{aligned} \text{Equating} & \quad 8q + 4(300 - q) = 2,200 \\ \text{or} & \quad 8q + 1,200 - 4q = 2,200 \\ \text{or} & \quad q = 250. \end{aligned}$$

Proposed mix $X = 250$ units

$Y = 50$ units

300 units

===

Acceptance of Offer--P/V Ratio

Problem 9.5. *X Ltd.* has been offered an order from *A Ltd.* for 10,000 units of output @ Rs. 100 each which has a variable cost of Rs. 60 and will involve an outlay of Rs. 60,000 for set-up, jigs and dies. At the same time, there is another offer of *B Ltd.* for 8,000 units of output at Rs. 110 each. Variable costs are estimated at Rs. 68 each and involves an outlay of Rs. 50,000 for set-up, jigs and dies. Which offer should the company accept? (I.C.W.A. Inter., Dec. 1984)

Solution :

	<i>A Ltd.</i>	<i>B. Ltd.</i>
Output (units)	10,000	8,000
Price per unit	Rs. 100	Rs. 110
Less : Variable cost	60	68
Contribution	40	42
P/V Ratio	40%	38%
Total contribution	4,00,000	3,36,000
Less : Outlay (fixed cost)	60,000	50,000
Net Profit	3,40,000	2,86,000

Offer from *A Ltd.* should be accepted as both P/V Ratio and net profit are higher in this case.

Problem 9-6 (BE Analysis). (a) List out the usual assumptions that are underlying Break Even Analysis.

(b) A Company has an opening stock of 6,000 units of output. The production planned for the current period is 24,000 units and expected sales for the current period amount to 28,000 units. The selling price per unit of output is Rs. 10. Variable cost per unit is expected to be Rs. 6 per unit while it was only Rs. 5 per unit during the previous period. What is the Break Even volume for the current period if the total fixed costs for the current period is Rs. 86,000?

Assume that the First In First Out System is followed.

(C.A. Final, November 1987)

Solution (a) Refer to "Advanced Cost and Management Accounting—Text" by Saxena and Vashist.

(b) Step 1—Statement showing units produced and sold

Units in opening stock	6,000	Units Sold.		
Current Production	24,000	From Op. stock	6,000	
		„ Current production	22,000	28,000
			<hr/>	
		Closing Stock		2,000
				<hr/>
Total	<hr/> 30,000 <hr/>	Total		<hr/> 30,000 <hr/>

Step 2—Breakeven point is the level of sales at which contribution is just enough to meet fixed overhead.

Fixed overhead	=	Rs. 86,000
Less : Contribution of 6,000 units from opening stock		
6,000 units \times (Rs. 10—Rs. 5)	=	30,000
		<hr/>
Fixed overhead to be recovered by current production to breakeven		56,000
		<hr/>

Units of current production required to make a contribution of Rs. 56,000

Fixed overhead to be recovered \div Contribution per unit

= Rs. 56,000 \div (Rs. 10—Rs. 6) = 14,000 units

\therefore Breakeven volume in units = 6,000 + 14,000 = 20,000 units.

Problem 9.7 (Break-even Point of a Holiday Home) A local authority, whose area includes a holiday resort situated on the east coast, operates for 30 weeks each year, a holiday home which is let to visiting parties of children in care from other authorities. The children are accompanied by their own house mothers who supervise them throughout their holiday. From six to fifteen guests are accepted on terms of Rs. 100 per person per week. No differential charges exist for adults and children. Weekly costs incurred by the host authority are :

	Rs. per guest
Food	25
Electricity for heating and cooking	3
Domestic (laundry, cleaning etc.) expenses	5
Use of minibus	10

Seasonal staff supervise and carry out the necessary duties at the home at a cost of Rs. 11,000 for the 30-week period. This provides staffing sufficient for six to ten guests per week but if eleven or more guests are to be accommodated, additional staff at a total cost of Rs. 200 per week are engaged for the whole of the 30-week period.

Rent, including rates for the property, is Rs. 4,000 per annum and the garden of the home is maintained by the council's recreation department which charges a nominal fee of Rs. 1,000 per annum.

You are required to : (i) tabulate the appropriate figures in such a way as to show the breakeven point(s) and to comment on your figures.

(ii) draw, on the graph paper provided, a chart to illustrate your answer to (i) above.

(C.I.M.A. London, May 1987; I.C.W.A Final June, 1989—Adapted)

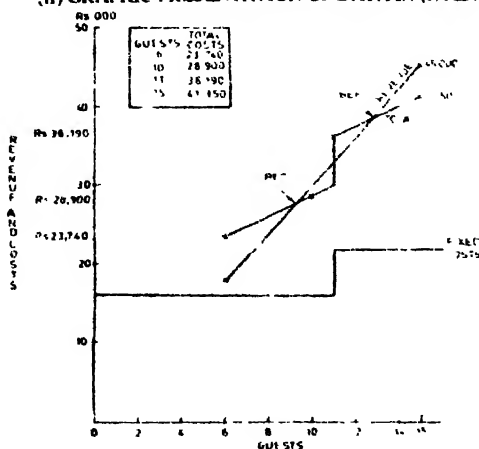
Solution. (i) Holiday Resort Costs and Income Statement

Guests in residence	Income p.a. (Rs.)	Variable Costs Rs.	Contribution Rs.	Fixed Cost Rs.	Surplus (deficit)
6	18,000*	7,740**	10,260	16,000	(5,740)
7	21,000	9,030	11,970	16,000	(4,030)
8	24,000	10,320	13,680	16,000	(2,320)
9	27,000	11,610	15,390	16,000	(610)
10	30,000	12,900	17,100	16,000	1,100
11	33,000	14,190	18,810	22,000	(3,190)
12	36,000	15,480	20,520	22,000	(1,480)
13	39,000	16,770	22,230	22,000	230
14	42,000	18,060	23,940	22,000	1,940
15	45,000	19,350	25,650	22,000	3,650

Comments. The break-even point occurs at two different levels of activity, but it is not possible to specify the exact number of guests required to break-even precisely. The first break-even point occurs just in excess of 9 guests per day, but clearly there can be only whole numbers. So management can work on figure of 9. Again, when fixed cost rises in excess of 10 guests per week, the break-even point would change to 13 guests per week.

*Rs. $100 \times 30 \times 6 = \text{Rs. } 18,000$; **Rs. $43 \times 30 \times 6 = \text{Rs. } 7,740$.

(II) GRAPHIC PRESENTATION OF DATA IN (I) ABOVE



Selling Prices under Monopoly and Competitive Conditions to meet Target Profit

Problem 9.8. In a purely competitive market, 10,000 pocket transistors can be manufactured and sold and a certain profit is generated. It is estimated that 2,000 pocket transistors need be manufactured and sold in a monopoly market to earn the same profit.

Profit under both the conditions is targeted at Rs. 2,00,000. The variable cost per transistor is Rs. 100 and the total fixed cost is Rs. 37,000.

You are required to find out the unit selling prices both under monopoly and competitive conditions. (I.C.W. 4. Inter, Dec 1989)

Solution :

Under Monopolistic Conditions

Suppose x is the selling price per unit			
∴ Sale	= 2,000 x		
Variable cost	= 2,000 × Rs. 100	or	Rs. 2,00,000
Fixed cost	= Rs. 37,000		
Desired profit	= Rs. 2,00,000.		
or 2,000 x - 2,00,000	= 37,000 + 2,00,000		
or	$x = \frac{4,37,000}{2,000}$	or	Rs. 218.50 per unit

Under Competitive Conditions

Suppose y is the selling price per unit			
Sale	= 10,000 y		
Variable cost	= 10,000 × Rs. 100	or	Rs. 10,00,000
Fixed cost	= Rs. 37,000		
Desired profit	= Rs. 2,00,000		
or 10,000 y - 10,00,000	= 2,37,000		
or	$y = \frac{12,37,000}{10,000}$	or	Rs. 123.70 per unit.

1. Under monopolistic conditions selling price per unit is Rs. 218.50.

2. Under competitive conditions selling price per unit is Rs. 123.70.

Profitability due to Discontinuance of a Product

Problem 9.9. The Skyrock Ltd. produces and sells three types of products P, Q and R. The management committee has decided to discontinue the production of 'Q' since there is not much profit in it. From the following set of information find out the profitability of the products and give your short comments on the decision of the management.

	Selling Price per unit	Direct material per unit	Direct wages per unit		
			Dept. A	Dept. B	Dept. C
P	Rs. 300	Rs. 60	Rs. 20	Rs. 15	Rs. 10
Q	275	30	20	20	10
R	305	70	12	10	20

The absorption rates of overhead on Direct wages are :

	Dept. A	Dept. B	Dept. C
Variable overhead	150%	120%	200%
Fixed overhead	200%	240%	150%

{I.C.W.A. Inter, June, 1986 & C.A. (F.), May 1982 Modified}

Solution :

Skyrock Ltd.

	P	Q	R
1. Selling Price per unit	Rs. 300	Rs. 275	Rs. 305
2. Direct Material	60	30	70
3. Direct Wages			
Deptt. A	20	20	12
" B	15	20	10
" C	10	10	20
4. Prime Cost (2+3)	105	80	112
5. Variable Overhead			
Deptt. A (150% of D. wages)	30	30	18
Deptt. B (120% of D. wages)	18	24	12
Deptt. C (200% of D. wages)	20	20	40
Total	68	74	70
6. Total variable cost (4+5)	173	154	182
7. Contribution (1-6)	127	121	123
8. Fixed Cost			
Deptt. A (200% of D. wages)	40	40	24
Deptt. B (240% of D. wages)	36	48	24
Deptt. C (150% of D. wages)	15	15	30
Total	91	103	78
9. Profit (7-8)	36	18	45
10. P/V Ratio	42%	44%	40%

Comments

The management has taken a view to discontinue product Q based on unitary profit. This is a wrong decision. This decision should be based on P/V ratio, which is highest in Product Q. Management should explore the possibility of increasing the production of product Q, because this step will increase the total profit of the company owing to better P/V ratio of product Q. By discontinuing product Q, its share of fixed cost will be borne by products P and R and thus total profit of company will reduce.

Profit Planning and B.E. Point

Problem 9-10. S. Ltd. furnishes you the following information relating to the half year ending 30th June, 1986.

Fixed expenses	Rs. 50,000
Sales value	2,00,000
Profit	50,000

During the second half of the same year the company has projected a loss of Rs. 10,000. Calculate :

(i) The P/V ratio, break-even point and margin of safety for six months ending 30th June 1986.

(ii) Expected sales volume for second half of the year assuming that selling price and fixed expenses remain unchanged in the second half year also.

(iii) The break-even point and margin of safety for the whole year 1986. *(I.C.W.A. Inter, Dec. 1989)*

Solution : (i) Fixed expenses	Rs. 50,000
Profit	50,000
Contribution	<u>1,00,000</u>

P/V Ratio	$= (\text{Contribution}/\text{Sales}) \times 100$ $= \text{Rs. } 1,00,000 \div 2,00,000 \text{ or } 50\%$
B.E. Point	$= \text{Fixed Cost}/\text{P.V. Ratio} = \text{Rs. } 50,000 \div 50\%$ $= \text{Rs. } 1,00,000$
Margin of Safety	$= \text{Sales} - \text{B.E. Sales}$ $= \text{Rs. } 2,00,000 - \text{Rs. } 1,00,000 \text{ or Rs. } 1,00,000.$

(ii) Expected Sales Volume for Second half

Fixed Cost	Rs. 50,000 (unchanged)
Loss	<u>10,000</u>
Contribution	<u>40,000</u>

$$\begin{aligned} \text{P/V Ratio} &= \text{Contribution/Sales} \\ \text{Expected Sales} &= \text{Contribution/P.V. Ratio} \\ &= 40,000 \div 50\% = \text{Rs. } 80,000. \end{aligned}$$

(P/V Ratio will remain unchanged if there is no change in S.P.)

(iii) **For whole year**

$$\begin{aligned} \text{Contribution (Rs. } 1,00,000 + \text{Rs. } 40,000) & \text{ Rs. } 1,40,000 \\ \text{Sales} & 2,80,000 \\ \text{P/V Ratio} & 50\% \text{ (unchanged)} \\ \text{B.E. Sales} & = \text{Fixed Cost/P.V. Ratio} \\ & = \text{Rs. } 1,00,000 \div 50\% \text{ or Rs. } 2,00,000 \\ \text{Marginal of safety} & = \text{Rs. } 2,80,000 - 2,00,000 = \text{Rs. } 80,000. \end{aligned}$$

Overall B.E. Point of Sales Mix

Problem 9 11. (a) Calcutta Company Ltd. manufactures and sells four types of products under the brand names ACE, UTILITY, LUXURY and SUPREME. The sales mix in value comprises the following

Brand	Percentage
Ace	33½%
Utility	41½%
Luxury	16½%
Supreme	8½%
	<hr/> 100% <hr/>

The total budgeted Sales (100%) are Rs. 6,00,000 per month.

The operating costs are :

Ace	50% of selling price
Utility	68% of selling price
Luxury	80% of selling price
Supreme	40% of selling price.

The fixed costs are Rs. 1,59,000 per month. Calculate the break-even point for the products on an overall basis.

(b) It has been proposed to change the sales mix as follows. the total sales per month remaining Rs. 6,00,000 :

Brand	Percentage
Ace	25%
Utility	40%
Luxury	30%
Supreme	5%
	<hr/> 100 <hr/>

Assuming that this proposal is implemented, calculate the new break-even point.
(C.A. Final, Nov. 1986)

Solution :

Calcutta Company Ltd.

(a) Calculation of B.E. Point for the Products on an Overall Basis

	<i>Ace</i>	<i>Utility</i>	<i>Luxury</i>	<i>Supreme</i>	<i>Total</i>
Sales Mix	33½%	41½%	16½%	8½%	100%
	Rs.	Rs.	Rs.	Rs.	Rs.
Sales	2,00,000	2,50,000	1,00,000	50,000	6,00,000
Less : Operating costs (Variable)	1,20,000	1,70,000	80,000	20,000	3,90,000
	80,000	80,000	20,000	30,000	2,10,000

B.E. Sales \times Overall P/V Ratio = Fixed Cost

$$\text{or B.E. Sales} \times \frac{2,10,000}{6,00,000} = \text{Rs. } 1,59,000$$

$$\text{or B.E. Sales} = 1,59,000 \times \frac{6,00,000}{2,10,000} \quad \text{or Rs. } 4,54,286.$$

(b) Calculation of New B.E. Point with Revised Sales Mix

	<i>Ace</i>	<i>Utility</i>	<i>Luxury</i>	<i>Supreme</i>	<i>Total</i>
Revised Sales mix	25%	40%	30%	5%	100%
	Rs.	Rs.	Rs.	Rs.	Rs.
Sales	1,50,000	2,40,000	1,80,000	30,000	6,00,000
Less : Operating costs (variable)	90,000	1,63,200	1,44,000	12,000	4,09,200
	60,000	76,800	36,000	18,000	1,90,800

New B.E. Point \times Overall P/V Ratio = Fixed Cost

$$\text{New B.E. Point} \times \frac{1,90,800}{6,00,000} = 1,59,000$$

$$\text{New B.E. Point} = 1,59,000 \times \frac{6,00,000}{1,90,800} \quad \text{or Rs. } 5,00,000.$$

Problem 9-12 (B.E. Analysis) Mr. X has Rs. 2,00,000 investments in his business firm. He wants a 15 per cent return on his money. From an analysis of recent cost figures, he finds that his variable cost of operating is 60 per cent of sales, his fixed costs are Rs. 80,000 per year. Show computations to answer the following questions :

(i) What sales volume must be obtained to break even ?

(ii) What sales volume must be obtained to get 15 per cent return on investment ?

- (iii) Mr. X estimates that even if he closed the doors of his business, he would incur Rs. 25,000 as expenses per year. As what sales would he be better off by locking his business up.

(I.C.W.A. Inter, December 1987; C.A. Inter November 1987—

Adapted C.S. Inter June 1986—Adapted)

Solution.

Suppose sales	Rs. 100	
Variable cost	60	
	<hr/>	
Contribution	40	
	<hr/>	
P/V Ratio	40%	
Fixed cost	=Rs. 80,000	
(i) B.E. Point = Fixed cost ÷ P/V Ratio		
	= 80,000 ÷ 40%	or Rs. 2,00,000
(ii) 15% return on Rs. 2,00,000		Rs. 30,000
Fixed Cost		80,000
		<hr/>
Contribution required		1,10,000

Sales volume required = Rs. 1,10,000 ÷ 40% or Rs. 2,75,000

- (iii) Fixed cost even if business is locked up = Rs. 25,000.

Minimum sales required to meet this cost:

= Rs. 25,000 ÷ 40% or Rs. 62,500.

Mr. X will be better off if the sale is more than Rs. 62,500.

Budgeted Net Revenue and Break-even Number

Problem 9-13. Kalyan University conducts a special course on "Computer Applications" for a month during summer. For this purpose it invites applications from graduates. An entrance test is given to the candidates and based on the same, a final selection of a hundred candidates is made. The Entrance Test consists of four objective type of examinations and is spread over four days, one examination per day. Each candidate is charged a fee of Rs. 50 for taking up the entrance test. The following data was gathered for the past two years:

Kalyan University

Statement of Net Revenue from the Entrance Test for the course on "Computer Application"

	1985	1986
Gross Revenue (Fees collected)	Rs. 1,00,000	Rs. 1,50,000
Costs :		
Valuation	40,000	60,000
Question Booklets	20,000	30,000
Hall Rent at Rs. 2,000 per day	8,000	8,000

Honorarium to Chief Administrator	6,000	5,000
Supervision Charges (one Supervisor for every 100 candidates at the rate of Rs. 50 per day)	4,000	6,000
General Administration Expenses	6,000	6,000
Total Cost	84,000	1,16,000
Net Revenue	16,000	34,000

You are required to compute :

- The budgeted net revenue if 4,000 candidates take up the entrance test in 1987.
- The break-even number of candidates.
- The number of candidates to be enrolled if the net income desired is Rs. 20,000. *(C.A. Inter, May 1987)*

Solution :

(a) Statement showing Budgeted Net Revenue from the Entrance Test in 1987

Number of candidates	4,000
(A) Gross revenue (fees collected) $4,000 \times 50$	Rs. 2,00,000

Costs :

Variable — Valuation ($4,000 \times \text{Rs. } 20$)	80,000	
— Question booklets ($4,000 \times \text{Rs. } 10$)	40,000	
— Supervision charges* ($4,000 \times \text{Rs. } 2$)	8,000	
	1,28,000	
Contribution		72,000
Fixed — Hall rent ($\text{Rs. } 2,000 \times 4 \text{ days}$)	8,000	
— Honorarium to chief administrator	6,000	
— General administrative expenses	6,000	
(B) Total Cost (Variable + Fixed)	20,000	1,48,000
Net Revenue (A — B)		52,000

Note. Gross revenue is given. Number of candidates can be found out by dividing gross revenue with fees charged per candidate.

*Supervision costs vary with every 100 candidates. If the candidates are less than 100, it becomes fixed.

(b) Break-even Number of Candidates

$$\begin{aligned}
 P/V \text{ Ratio} &= (72,000 \div 2,00,000) \times 100 \quad \text{or } 36\% \\
 \text{Contribution per candidate} &= 72,000 \div 4,000 \quad \text{or Rs. 18} \\
 \text{B.E. number of candidates} &= \text{Fixed cost} \div \text{Contribution per candidate} \\
 &= \text{Rs. } 20,000 \div 18 \text{ or } 1,111.11 \text{ candidate.}
 \end{aligned}$$

Supervision cost is semi-fixed if the candidates are less than 100 in number. This cost is variable if the candidates are in multiple of 100. The supervision charges are recovered to the extent of 1,100 candidates. For 11.11 candidates another supervisor has to be engaged for four days. The supervision charges will be Rs. 50×4 days = Rs. 200 (fixed cost). The variable cost @ Rs. 2 per candidate has already been recovered. The unrecovered fixed cost will be Rs. $200 - (11.11 \times \text{Rs. } 2)$ as or Rs. 177.78. Additional 8.89 units (Rs. $177.78 \div \text{Rs. } 20$)* will have to be added to the existing BEP. Hence the revised

$$\text{BEP} = 1111.11 + 8.89 = 1,120 \text{ candidates.}$$

(c) No. of Candidates Enrolled if the Net Income Desired is Rs. 20,000

$$\begin{aligned}
 &\frac{\text{Fixed cost} + \text{Profit}}{\text{Contribution per candidate}} \\
 &\text{Rs. } 20,000 + \text{Rs. } 20,000 \div \text{Rs. } 18 = 2222.22 \text{ candidates.}
 \end{aligned}$$

If 2222 candidates additional fixed cost will be :
= Rs. $200 - (22.22 \times 2)$ or Rs. 155.56.

To recover this amount 7.78 candidates will have to be added to 2,222.22. Thus, the desired number of candidates
= $2222.22 + 7.78$ or 2,230 candidates.

*Gross revenue	Rs. 2,00,000
Less : Variable cost without supervision charges	1,20,000
	<hr/>
	80,000
	<hr/>
No. of candidates in 1987	4,000
	<hr/>
Revised contribution per candidate	Rs. 20.

Sensitivity Analysis and B.E. Sales

Problem 9.14 The following figures relate to the current year's position in an engineering industry operating at 70% capacity level :

Break-even point	Rs. 80 crores
P/V ratio	40%
Margin of safety	Rs. 20 crores

The Board at its last meeting have taken a decision to increase the output to 98% capacity level with the following modifications :

- (i) Reduction in selling price by 5%.
- (ii) Increase in fixed cost by Rs. 8 crores (including depreciation on additions but excluding interest burden).
- (iii) Reduction in variable cost by 5% of sales.
- (iv) Additional finance for capital expenditure and working capital—Rs. 20 crores.
- (a) You are required to determine the revised sales figure necessary to yield the existing quantum of profit plus additional profit of Rs. 4 crores on account of increased activity and 20% interest burden on fresh capital inputs.
- (b) Also determine the revised :
 - (i) Break-even point.
 - (ii) P/V ratio.
 - (iii) Margin of safety.

(c) Speedy Airline can carry a maximum of 10,000 passengers per month on one of its routes at a fare of Rs. 85.

Variable costs are Rs. 10 per passenger and fixed costs are Rs. 3,00,000 p.m. Calculate :

- (i) Break-even quantity
- (ii) Break-even sales
- (iii) Break-even percentage of capacity
- (iv) Suppose that the management sets a profit target of Rs. 2,00,000. What would be the required profit before taxes to achieve this profit target, if the corporate tax rate of the company is 46% ?

(CS. Final, June 1986)

Solution : Existing Position

BES × P/V Ratio	= Fixed cost	
Fixed cost	= Rs. 80 crores × 40%	or Rs. 32 crores
Sales—BES	= Margin of safety	
Sales—Rs. 80 crores	= Rs. 20 crores	
or Sales	= Rs. 100 crores	

If P/V Ratio is 40%, variable cost is 60% of sales.

Variable cost = Rs. 100 × 60% or Rs 60 crores.
(Rs./crores)

Sales	= 100
Variable cost	= 60
Contribution	40
Less : Fixed cost	32
Profit	8

(a) Revised Position

1. Revised selling price	Rs./crores. 95.00
2. Variable cost 60% less 5% = 55% of sales	52.25
3. Contribution	42.75
4. Revised P/V Ratio $(3 \div 1) \times 100$	45%
	Rs./crores
Fixed cost	32
Increase in fixed cost (including depreciation)	8
Interest (20% of Rs. 20 crores)	4
Revised fixed cost	44
Revised profit (8+4)	12

$$\begin{aligned} \text{Sales} \times \text{P/V Ratio} &= \text{Fixed cost} + \text{Profit} \\ \text{Sales} &= \frac{\text{Rs. 44 crores} + \text{Rs. 12 crores}}{45\%} \end{aligned}$$

$$= \text{Rs. 124.44 crores.}$$

$$\begin{aligned} (b) \text{ (i) Revised BEP} &= \frac{\text{Fixed Cost}}{\text{P/V Ratio}} = \frac{\text{Rs. 44 crores}}{45\%} \\ &= \text{Rs. 97.78 crores.} \end{aligned}$$

$$\begin{aligned} \text{(ii) Revised P/V Ratio} &= 45\% \text{ [as at (a) above]} \end{aligned}$$

$$\begin{aligned} \text{(iii) Margin of Safety} &= \text{Sales} - \text{BES} \\ &= \text{Rs. 124.44 crores} - \text{Rs. 97.78 crores} \\ &= \text{Rs. 26.66 crores.} \end{aligned}$$

$$\begin{aligned} \text{(c) Sales} &= \text{Rs. 85 per passenger} \end{aligned}$$

$$\text{Variable cost} = 10$$

$$\text{Contribution} = 75$$

$$\text{P/V Ratio} = \frac{75}{85} \% \text{ or } \frac{5}{17} \%$$

$$\text{(d) Revised Break-Even Point (Qty.)}$$

$$= \frac{\text{Fixed cost}}{\text{Contribution per unit}}$$

$$= \text{Rs. 3,00,000} \div 75 \text{ or 4,000 passengers}$$

$$\text{(e) Revised Break-even Point (value)}$$

$$= \frac{\text{Fixed Cost}}{\text{P/V Ratio}}$$

$$= \text{Rs. } 3,00,000 + \left(\frac{15}{17} \% \right) \quad \text{or Rs. } 3,40,000.$$

(iii) Break-Even Percentage of Capacity
 $= 4,000 \div 10,000$ or 40%

(iv) Suppose the profit before tax is	100
Tax	46
Profit after tax	54

If profit after tax is 54 then profit before tax = 100

If profit after tax is Rs. 2,00,000 then profit before tax

$$= \frac{100}{54} \times 2,00,000$$

Rs. 3,70,370.

Evaluation of Multiple Proposals of Closing down a Factory

***Problem 9-15.** Z Ltd. manufactures a high quality car radio, which sells for Rs. 100. Its head office is located in the South and it operates three factories in the East, West and North, results for which are as shown below.

Profit and Loss Statement for the year ended 31st December

(Rs. in thousands)

	East	West	North	
Sales	16,000	12,000	5,000	
Direct material	3,840	2,880	1,200	
Direct wages	1,760	1,200	450	
Production overhead :				
Variable	640	720	250	
Fixed	2,400	1,600	700	
Administration overhead	2,800	2,000	1,000	
Selling overhead				
Variable	480	360	100	
Fixed	1,160	900	400	
Head office exp apportioned	2,000	1,500	600	
	15,080	11,160	4,700	
Profit	920	840	300	

Management is considering its strategy for next year, particularly in the light of the bad news that one of North factory's main customers (Exe. p.l.c. which takes 10,000 radios per annum) has gone into liquidation. A number of alternatives have been suggested and are shown below :

1. Continue operations at East and West, but reduce output at North on the assumption that no market can be obtained to replace Exe. p.l.c.
2. Continue operations at East and West and operate North at its break-even level of sales.
3. Continue operations at all three factories and accept an offer from an overseas car manufacturer who is prepared to buy from North 10,000 radios per annum at a special price of Rs. 80.
4. Continue operations at West as at present and transfer the remaining production requirements of North to West. See note below :
5. Continue operations at East as at present and transfer the remaining production requirements of North to West. See note below :

Note : You may assume that there would be no costs of closing down the North factory ; in other words, realisable value of assets would offset redundancy payment, etc. However, if the North factory is closed down additional costs would be incurred at the factory which undertook the production requirements which were transferred from North. These costs are estimated as :

	East	West
Transport cost to customers of North (per unit)	Rs. 2	Rs. 4
Fixed cost per annum production	8,50,000	6,00,000
Administration	4,00,000	3,00,000
Selling	2,40,000	3,00,000

You are required to present your evaluation of the five proposals.

(CIMA, London, Nov. 1986, Adapted)

Solution : Workings

Step 1—Present the information for marginal cost analysis.

	East	West	North
Units sold	1,60,000	1,20,000	50,000
			(Rs. in thousand)
Sales	16,000	12,000	5,000
Less : Variable cost			
D. Materials	3,840	2,880	1,200
D. Wages	1,760	1,200	450

Production OH. (variable)	640	720	250	
Selling OH. (variable)	480	360	100	
	<u>6,720</u>	<u>5,160</u>	<u>2,000</u>	
Contribution	9,280	6,840	3,000	
Less : Fixed cost	2,400	1,600	700	
Adm. OH.	2,800	2,000	1,000	
Selling	1,160	900	400	
Head Office (apportioned)	2,000	1,500	600	
	<u>8,360</u>	<u>6,000</u>	<u>2,700</u>	
Profit	920	840	300	

Contribution per unit	Rs. 58	Rs. 57	Rs. 60	
	<i>East</i>	<i>West</i>	<i>North</i>	<i>Total</i>
(i) Units Sold	1,60,000	1,20,000	40,000	
	Rs	Rs.	Rs.	Rs.
Contribution	92,80,000	68,40,000	24,00,000	
Less : Fixed cost	83,60,000	60,00,000	27,00,000	
Profit	9,20,000	8,40,000	(3,00,000)	14,60,000
(ii)	<i>East</i>	<i>West</i>	<i>North</i>	<i>Total</i>
Units sold	1,60,000	1,20,000	45,000*	
	Rs.	Rs.	Rs.	Rs.
Contribution	92,80,000	68,40,000	27,00,000	
Less : Fixed cost	83,60,000	60,00,000	27,00,000	
Profit	9,20,000	8,40,000	-	17,60,000

*BEP = Fixed cost ÷ Contribution per unit.

(iii)	<i>East</i>	<i>West</i>	<i>North</i>	<i>Total</i>
Units sold - Inland	1,60,000	1,20,000	40,000	
— Export	—	—	10,000	

	Rs.	Rs.	Rs.	Rs.
Contribution	92,80,000	68,40,000	24,00,000 4,00,000* }	
Less : Fixed cost	83,60,000	60,00,000	27,00,000	
	<u>9,20,000</u>	<u>8,40,000</u>	<u>1,00,000</u>	<u>18,60,000</u>

*(Selling price of Rs. 80— variable cost per unit of Rs. 40) × 10,000 units.

(iv) East West Total

Units Sold

Originally	Rs. 1,60,000 }	Rs. 1,20,000	
Additional after transfer	40,000 }		
Contribution	92,80,000 }	Rs. 68,40,000	
	*22,40,000 }		
	<u>1,15,20,000</u>	<u>68,40,000</u>	
Less : Fixed cost original	83,60,000	60,00,000	
Additional : Production	8,50,000		
Administration	4,00,000		
Selling	2,40,000		
H O. Exp. of North	6,00,000		
Total Fixed cost	<u>1,04,50,000</u>	<u>60,00,000</u>	
Profit	<u>10,70,000</u>	<u>8,40,000</u>	Rs <u>19,10,000</u>

*(Original Contribution of Rs. 58 00 Rs 2 00) × 40,000 units.

(v) East West Total

Units Sold

Originally	1,60,000	1,20,000	
Additional after transfer		40,000	
Contribution	Rs 92,80,000	Rs 68,40,000 }	
		*21,20,000 }	
Less : Fixed cost			
Original	83,60,000	60,00,000	
Additional— Production		6,00,000	

Administration		3,00,000	
Selling		3,00,000	
H.O exp. of North		6,00,000	
Total Fixed cost	83,60,000	78,00,000	
Profit	9,20,000	11,60,000	Rs. 20,80,000
*(57 - 4) × 40,000 units.			

Determination of Profits and B.E. Points

Problem 9-16. Three firms X, Y and Z manufacture the same product. The selling price is Rs. 8 per unit. The fixed costs for firms X, Y and Z are Rs. 80,000, Rs. 2,00,000 and Rs. 3,30,000, respectively, while the variable costs per unit are Rs. 6, Rs. 4 and Rs. 3. Determine the break-even points for all the firms. How much profits are earned by the firms if each of them sells 80,000 units? (C.S. Final, December 1984)

Solution :

	Firms		
	X	Y	Z
1. Selling price/unit	Rs. 8	Rs. 8	Rs. 8
2. Variable Cost/Unit	6	4	3
3. Contribution per unit	2	4	5
4. Fixed Costs	Rs. 80,000	Rs. 2,00,000	Rs. 3,30,000
5. B.E. Point (Units) [4 ÷ 3]	40,000	50,000	66,000
6. B.E. Point (Value) [5 × 1]	Rs. 3,20,000	Rs. 4,00,000	5,28,000
7. Total contribution at 80,000 (80,000 × col. 3)	Rs. 1,60,000	Rs. 3,20,000	4,00,000
8. Fixed Cost	80,000	2,00,000	3,30,000
9. Profit (6 - 7)	Rs. 80,000	1,20,000	70,000

Profitability of Two Methods of Production

Problem 9-17. Gemini Publishers Ltd., is considering launching a new monthly magazine at a selling price of Rs. 10 per copy. Sales of the magazine are expected to be 5,00,000 copies per month, but it is possible that the actual sales could differ quite significantly from this estimate.

Two different methods of producing the magazine are being considered and neither would involve any additional capital expenditure. The estimated production cost for each of the two methods of manufacture, together with the additional marketing and distribution costs of selling the new magazine, are given below :

	<i>Method A</i>	<i>Method B</i>
Variable Costs	Rs. 5.50 per copy	Rs. 5.00 per copy
Specific Fixed Costs	Rs. 8,00,000 per month	Rs. 12,00,000 per month

Semi-variable Costs :

The following estimates have been available :

3,50,000 copies	Rs. 5,50,000 per month	Rs. 4,75,000 per month
4,50,000 copies	Rs. 6,50,000 per month	Rs. 5,25,000 per month

It may be assumed that the fixed cost content of the semi-variable cost will remain constant throughout the range of activity shown.

The company currently sells a magazine covering related topics to those that will be included in the new publication, and consequently, it is anticipated that sales of this existing magazine will be adversely affected. It is estimated that for every ten copies sold of the new publication, sales of the existing magazine will be reduced by one copy.

Sales and cost data of the existing magazine are as shown below :

Sales	2,20,000 copies per month
Selling price	Rs. 8.50 per copy
Variable costs	Rs. 3.50 per copy
Specific fixed costs	Rs. 8,00,000 per month

Required :

(a) Calculate, for each production the net increase in company profits which will result from the introduction of the new magazine, at each of the following levels of activity :

5,00,000	copies per month
4,00,000	copies per month
6,00,000	copies per month.

(b) Calculate, for each production method, the amount by which sales volume of the new magazine could decline from the anticipated 5,00,000 copies per month, before the company makes no additional profit from the introduction of the new publication.

(c) Briefly identify any conclusions which may be drawn from your calculations.
(C.A. Final, May 1987)

Solution : Working

1. Analysis of Semi-Variable Costs

$$\text{Variable cost per unit} = \frac{\text{Increase in cost}}{\text{Increase in activity}}$$

<i>Method A</i>	<i>Method B</i>
$\text{Rs. } 6,50,000 - 5,50,000$	$\text{Rs. } 4,75,000 - 5,25,000$
$3,50,000 - 4,50,000$	$3,50,000 - 4,50,000$
$1,00,000 - 1,00,000$	$\text{Rs. } 50,000 \div 1,00,000$
= Rs. 1 per copy	= Re. 0.50 per copy
Fixed element = Total Semi-variable element - Variable cost	
= Rs. 5,50,000 - Rs. 3,50,000	= Rs. 4,75,000 - Rs. 1,75,000 "
= Rs. 2,00,000.	= Rs. 3,00,000

2. Total Fixed Cost

	<i>Method A</i>	<i>Method B</i>
Specific fixed cost	Rs. 8,00,000	Rs. 12,00,000
Add : Fixed element in Semi-variable	2,00,000	3,00,000
	<u>10,00,000</u>	<u>15,00,000</u>

3. Contribution per unit of Existing Magazine

Selling price	Rs. 8.50
Variable cost	3.50
	<u>5.00</u>

∴ Contribution lost for each new Magazine = $\text{Rs. } \frac{5}{10}$ = Re. 0.50

4. Contribution per copy of New Magazine

	<i>Method A</i>	<i>Method B</i>
Selling Price	Rs. 10.00	Rs. 10.00
Variable Costs	Rs. 5.50	Rs. 5.00
Variable element in semi-variable	1.00	0.50
One-tenth contribution of existing Magazine (Refer to point 3)	0.50	0.50
Total variable costs	<u>7.00</u>	<u>6.00</u>
Contribution	<u>3.00</u>	<u>4.00</u>

(a) Increase in Company Profits

<i>Method A</i>	<i>Level of Activity</i>		
Copies Sold	5,00,000	4,00,000	6,00,000
Contribution	Rs. 15,00,000	Rs. 12,00,000	Rs. 18,00,000
Less : Fixed Cost (Refer to point 2)	<u>10,00,000</u>	<u>10,00,000</u>	<u>10,00,000</u>
Increase in profit	<u>5,00,000</u>	<u>2,00,000</u>	<u>8,00,000</u>

<i>Method B</i>	<i>Level of activity</i>		
Copies Sold	5,00,000	4,00,000	6,00,000
	<u> </u>	<u> </u>	<u> </u>
Total Contribution	Rs. 20,00,000	Rs. 16,00,000	Rs. 24,00,000
Less : Fixed Cost (Refer to point 2)	15,00,000	15,00,000	15,00,000
	<u> </u>	<u> </u>	<u> </u>
	5,00,000	1,00,000	9,00,000
	<u> </u>	<u> </u>	<u> </u>

(b) Break-even Point

$$\text{BES} \times \text{P/V Ratio} = \text{Fixed Cost}$$

$$\text{Method A—BES} \times \frac{10}{3} = \text{Rs. } 10,00,000 \quad \text{or } \text{BES} = \text{Rs. } 33,33,333.$$

$$\text{BES} = \frac{\text{Rs. } 33,33,333}{10} = 3,33,333 \text{ Copies}$$

$$\text{Method B—BES} \times \frac{4}{15} = \text{Rs. } 15,00,000 \quad \text{or } \text{Rs. } 56,25,000$$

$$\text{BES} = \frac{\text{Rs. } 56,25,000}{15} = 3,75,000 \text{ Copies}$$

\therefore **Margin of Safety**, i.e., decline from 5,00,000 copies before company breaks-even.

$$\text{Method A} = 5,00,000 - 3,33,333 = 1,66,667 \text{ Copies.}$$

$$\text{Method B} = 5,00,000 - 3,75,000 = 1,25,000 \text{ Copies.}$$

(c) This is clear from the above analysis that B has higher contribution and higher break-even point.

$$\begin{aligned} \text{Break-even point of existing magazine} &= \frac{8,00,000}{\text{Rs. } 5} \\ &= 1,60,000 \text{ Copies.} \end{aligned}$$

The current level of sales is 2,20,000.

\therefore Sales can drop by 60,000 copies before the company breaks even.

For every 10 copies sold of new magazine, the sale of existing magazine will be reduced by one copy. Therefore, if production exceeds 6,00,000 copies, the existing magazine will start incurring losses.

Variation in Sales and CVP Analysis

Problem 9.18. The cost-volume-profit relationship of a company is described by the equation $y = \text{Rs. } 1,40,000 + 0.7x$, in which x represents sales revenue and y is the total cost at the sales volume represented by x . Find out the following :

(i) P/V Ratio

(ii) Break-even point

(iii) Company wants to increase profit by Rs. 60,000, what will be the sales?

(iv) Increase in profit if sales increase by Rs. 30,000.

(v) Sales volume required to produce an income of Rs. 90,000.

(C.P.A. Adapted)

Suggested Approach

In this question relationship of variable cost and sales value is given. Based on this relationship, P/V ratio can be found out.

Solution : Given $y = \text{Rs. } 2,40,000 + 0.7x$

where $y = \text{Total cost}$ (Fixed cost and variable cost)

$x = \text{Sales Revenue}$

$\therefore \text{Fixed cost} = \text{Rs. } 2,40,000$

and variable cost will be $7/10$ of sales value

Suppose sales value = Rs. 100

Variable cost will be = Rs. $\frac{7}{10} \times 100 = \text{Rs. } 70$

$$\begin{aligned} \text{P/V ratio} &= \frac{S - V}{100} \quad \text{or} \quad \frac{\text{Rs. } 100 - \text{Rs. } 70}{\text{Rs. } 100} \\ &= 30\% \end{aligned}$$

(ii) $\text{BES} \times \text{P/V Ratio} = F$

(\because at B.E.P. Fixed cost is equal to contribution)

$$\therefore \text{BES} \times \frac{30}{100} = \text{Rs. } 2,40,000 \quad \text{or} \quad \text{BES} = \text{Rs. } 8,00,000.$$

(iii) Sales required for profit of Rs. 60,000

$$S \times \text{P/V ratio} = F + P$$

$$\text{or} \quad S \times 30\% = \text{Rs. } 2,40,000 + \text{Rs. } 60,000$$

$$\text{or} \quad S = \frac{\text{Rs. } 3,00,000 \times 100}{30} \quad \text{or} \quad \text{Rs. } 10,00,000.$$

(iv) Increase in profit, if sales increase by Rs. 30,000.

At BES, i.e., Rs. 8,00,000 the profit is zero. To find out increase in profit corresponding to increase in sales by Rs. 30,000, profit on sales of Rs. 8,30,000 should be found out

$$\therefore S \times \text{P/V ratio} = F + P$$

$$\text{or} \quad 8,30,000 \times 30\% = \text{Rs. } 2,40,000 + P$$

$$\therefore P = \text{Rs. } 2,49,000 - \text{Rs. } 2,40,000 \quad \text{or} \quad \text{Rs. } 9,000$$

(v) Sales volume for profit of Rs. 90,000

$$S \times \text{P/V ratio} = F + P$$

$$\text{or} \quad S \times 30\% = \text{Rs. } 2,40,000 + \text{Rs. } 90,000$$

$$\text{or} \quad S = \frac{\text{Rs. } 3,30,000 \times 100}{30} \quad \text{or} \quad \text{Rs. } 11,00,000$$

Maximum Purchase Price for Raw Materials to Achieve the Target Profit

Problem 9-19. A company produces *X*, *Y* and *Z*, from a raw material *M*. For every 100 tonnes of *M* put into production, the following yield is obtained :

Product	Tonnes	Selling price per tonne
<i>X</i>	50	Rs. 40
<i>Y</i>	30	60
<i>Z</i>	15	80
Waste	5	

Relevant costs per tonne of input for the coming year are budgeted to be :

Raw material <i>M</i>	Rs. 20
Variable processing costs	10

Variable marketing costs are budgeted to be at the rate of 10% of sales value. Annual fixed overheads are budgeted to be as follows :

Manufacturing	Rs. 40,000 per annum
Marketing	30,000
Administration	20,000.

The company intends to process 10,000 tonnes of material *M* in the coming year. Required :

- The expected results for the year based on the above data.
- The break-even point in terms of sales value and tonnes of materials to be processed.
- The maximum price per tonne which the company can pay for its raw material in order to achieve a return of 15% in capital employed of Rs 5,00,000 assuming an input of 10,000 tonnes per year.
(I.C.W.A. Final, Dec. 1985 Adapted)

Solution : The yield is given for every 100 tonnes of material *M*. But the company intends to process 10,000 tonnes of material *M*. Therefore, for finding the yield for 10,000 tonnes, the yield of 100 tonnes should be multiplied by 100.

Expected Results for the Coming Year

	10,000 tonnes of <i>M</i>	Per unit of <i>M</i>
Sale : Product <i>X</i>	5,000 tonnes \times Rs. 40 = Rs. 2,00,000	
<i>Y</i>	3,000 tonnes \times Rs. 60	1,80,000
<i>Z</i>	1,500 tonnes \times Rs. 80	1,20,000
		<hr/>
		5,00,000
		<hr/>
		50
		<hr/>

Variable Costs :

Raw material <i>M</i>	2,00,000	20
Variable processing costs	1,00,000	10
Variable marketing costs (10% of sale value)	50,000	5
Total variable cost	3,50,000	35
Contribution	1,50,000	15
Less : Fixed costs		
Manufacturing	40,000	
Marketing	30,000	
Administration	20,000	
	90,000	9
Net profit	60,000	6

- (b) Break-even point = Fixed cost \div Contribution per unit
 = Rs. 90,000 \div 15 or 6,000 tonnes
 Sales value = Rs. 6,000 tonnes @ Rs. 50 = Rs. 3,00,000.

- (c) Capital employed = Rs. 5,00,000
 Rate of return = 15%
 Desired return = Rs. 75,000
 Earlier net profit = 60,000
 Additional return = 15,000

There is no change in fixed cost. Therefore, additional return of Rs. 15,000 will have to be achieved by reducing the raw material cost. The revised raw material cost will be Rs. 1,85,000 (Rs. 2,00,000 less Rs. 15,000). The maximum price per tonne the company can pay will be Rs. 18.50 (Rs. 1,85,000 \div 10,000 tonnes).

Evaluation of Different Proposals Considering Various Variable Factors

***Problem 9:21.** Nice and Warm Ltd. manufactures and markets hot plates. During the first five years of operations, the company has experienced a gradual increase in sales volume, and the current annual growth in sales of 5% is expected to continue in the foreseeable future. The plant is now producing at its full capacity of one lakh hot plates.

At the monthly Management Advisory Committee meeting, amongst other things, the plan of action for next year was discussed.

Managing Director proposed two alternatives. First, operatives could be continued at full capacity and with the existing facilities, an output of one lakh hot plates at a selling price of Rs. 100 per plate per unit could be maintained. Secondly, production and sales could be increased by 5% to take advantage of the rate of expansion in demand for the product.

But this could increase cost, as to achieve the output, the company will have to resort to weekend and overtime workings. However, a policy of steady growth was preferable to maintaining *status quo*.

In view of the company's competitors having a substantial share of the market, the Works Director was of the view that it was not enough for the company to maintain merely the present share of the total market. A large share of the total market should be obtained. For that, the company should increase production by 10% through a modest expansion of the plant capacity. In order to sell the output of 1,10,000 units the selling price could be reduced to Rs. 95 per unit.

Thinking on the same lines, the Marketing Director put forth a more radical proposal. The strategy should be to seize the competitive leadership in the market with regard to both price and volume. With this end in view, he suggested that the company should straightaway embark on an expensive modernisation programme, which will initially increase volume by 20%. The entire output of 1,20,000 hot plates could be easily sold at a price of Rs. 90 per unit.

At this juncture, the Managing Director expressed concern about the probable behaviour of the company's competitors. They might also expand in order to produce more and sell at lower prices. Suppose this happened, he wanted also the financial effects of the proposals of the Works Director and Marketing Director, if in those proposals, the expected increase in sales were to be only half of that predicted.

As a Cost Accountant of the company, you are required to critically evaluate the six alternatives along with your recommendations and circulate the same to the Directors. In this connection, you have gathered the following details :

(i) If next year's production was maintained at the current year's level, variable cost would remain at Rs. 50 per unit. Fixed cost would remain unchanged at Rs. 30 lakhs.

(ii) The week-end and overtime working would increase with the variable and fixed costs. Variable cost would rise to Rs. 55 per unit while fixed cost would increase to Rs. 30,25,000.

(iii) In the proposal of the Works Director, the ratio of variable costs to sales would continue to be 48%. Fixed costs would rise to Rs. 32,25,000.

(iv) In the proposal of Marketing Director, as a result of increased production, efficiency and some savings from purchase of materials, it is estimated that the ratio of variable cost to sales would decrease to 48% and the fixed costs would increase by Rs. 5,16,000.

Your answer should contain :

(a) A tabular statement of comparative figures pertaining to Total Turnover, Total Contribution, Percentage of Profit to Sales and Break-even units as regard to each of the six proposals.

- (b) Comments on the relative risk involved.
- (c) Consideration of the short-term and long-term implications of the Managing Director's proposals.
- (d) Comment on the price elasticity of demand for the company's products and your suggestions on the pricing policy and cost structure.
- (e) Comment on financial implications of the expansion scheme.

(C.A. Final, May 1984)

[For (a) see statement on next page]

Solution :

The results of all the six proposals are summarised below :

	<i>Percentage of Profit to sales (%)</i>	<i>Break-even Sales in units</i>	<i>Margin of Safety in units</i>	<i>P/V Ratio (%)</i>
Managing Director's 1st Proposal	20.00	60,000	40,000	50.00
Managing Director's 2nd Proposal	16.19	67,222	37,778	45.00
Works Director's 1st Proposal	19.14	67,895	42,105	50.00
Works Director's 2nd Proposal	17.67	67,895	37,105	50.00
Marketing Director's 1st Proposal	19.44	75,128	44,872	52.00
Marketing Director's 2nd Proposal	16.48	75,128	34,872	52.00

(b) Comments on Relative Risks Involved

Managing Director's first proposal is more favourable as the percentage of profit to sales is the highest and break-even sales is the lowest amongst other alternatives. Managing Director's, Works Director's and Marketing Director's second proposals bring down the present level of margin of safety, i.e., 40,000 units. Therefore from relevant risk point of view, the first proposal of the Managing Director to produce and sell 1,00,000 units is the only acceptable proposal.

(c) Managing Director's two proposals (i) production and sale at full capacity (1,00,000 units) and (ii) increase by 5% of production and sales coupled with weekend and overtime working are not very sound from long-term point of view. Increase in production and sales by 5% per annum is too meagre keeping in view the rate of inflation. As a short-term measure his first proposal is quite all right because the company has already reached 100% capacity utilization. Managing Director's attention is not attracted to grab competitors' market. This is possible only when the company is able to invest in expansion scheme by slightly reducing the selling price.

(Contd. on page P9'36)

NICE AND WARM LTD

(a) Statement showing the Comparative figures Pertaining to Total Turnover, Total Contribution, Percentage of Profit to Sales and Break-even Units, etc., for each of the four proposals

Details	Managing Director's 1st Proposal (output: 1 lakh at a selling price of Rs. 100 per unit)	Managing Director's 2nd Proposal (output: 1 lakh up by 5% with overtime working)	Managing Director's 1st Proposal (output: 1 lakh at a selling price of Rs. 100 per unit)	Managing Director's 2nd Proposal (5% increase in sales & output with price of Rs. 95 per unit)	Managing Director's 1st Proposal (20% increase in volume with selling price of Rs. 90 per unit)	Managing Director's 2nd Proposal (10% increase in volume with selling price of Rs. 90 per unit)
1. Units sold	1,00,000	1,05,000	1,10,000	1,05,000	1,20,000	1,10,000
2. Selling Price per unit (Rs.)	100.00	100.00	95.00	95.00	90.00	90.00
3. Total Turnover (Rs. in lakhs)	100.00	105.00	104.50	99.75	108.00	99.00
4. Variable cost per unit (Rs.)	50.00	55.00	47.50	47.50	43.20	43.20
5. Contribution per unit (Rs.) (2-4)	50.00	45.00	47.50	47.50	46.80	46.80
6. Total contribution (1×5)	50.00	47.25	52.25	49.875	56.16	51.48
7. Fixed cost (Rs. in lakhs)	30.00	30.25	32.25	32.25	35.16	35.16
8. Profit (6-7) (Rs. in lakhs)	20.00	17.00	20.00	17.625	21.00	16.32
9. Percentage of Profit to Sales (%) (8÷3) × 100	20.00	16.19	19.14	17.67	19.44	16.48
10. Break-even Sales in units (col. 7÷col. 5)	60,000	67,222	67,895	67,595	75,128	75,128
11. Margin of safety in units (col. 1-col. 10)	40,000	37,778	42,105	37,105	44,872	34,872
12. P/V Ratio (%) (col. 5÷col. 2) × 100	50.00	45.00	50.00	50.00	52.00	52.00

(d) It is given that the annual growth in sales of 5% is expected to continue into the foreseeable future. It is not clear why second proposal of Works Director and Marketing Director should suggest for reduction in price by 5% and 10% respectively. It seems no serious study has been made on the price elasticity of demand for the company's product. If there is substantial increase in production, then the company can resort to dual pricing or differential pricing. The company should also try to jump into the export markets. The company has not tried to reduce the cost of production by adopting modern cost reduction, value analysis or value engineering techniques.

(e) If the company decides to expand the production, it is necessary to find out the source of financing the expansion scheme. Relative profitability of borrowed funds and issue of equity shares should be studied in depth.

Profit Volume Analysis

Problem 9-22.

	1st Year	II Year
Sales	Rs. 2,00,000	Decrease in sales price and decrease in fixed cost are the only changes
M/S ratio	25%	M-S ratio 40%
P/V ratio	33 $\frac{1}{3}$ %	P/V ratio 30%

Required :

- Decreased sales amount in IInd year.
- Decreased fixed cost in IInd year.
- New profit in IInd year.
- New B.E.P. in IInd year.

Solution :

Analysis of Data for 1st year

Sales	Rs. 2,00,000
Variable cost 66 $\frac{2}{3}$ %	1,33,333
Contribution	66,667

Margin of Safety (25%)	= 2,00,000 \times 25% = Rs. 50,000
\therefore Break-even Point	= Sales - Margin of Safety
	= Rs. 2,00,000 - 50,000 or Rs. 1,50,000.
B.E.S. \times P/V ratio	= Fixed cost
1,50,000 \times $\frac{1}{3}$	= Fixed cost
Fixed cost	= Rs. 50,000.

∴ Data for 1st year can be summarised as follows :

Sales	Rs. 2,00,000
Variable cost	1,33,333
Contribution	66,667
Fixed cost	50,000
Profit	16,667

(a) **Decreased Sales Amount in IInd year**

Suppose revised sales = S .

Variable cost = Rs. 1,33,333 (∵ it remains the same)

Revised P/V ratio = 30% (P/V ratio is changing due to change in selling price only).

$$(S - V)/S = \text{P/V ratio}$$

$$(S - 1,33,333)/S = 3/10$$

Multiplying both the sides by S

$$S - 1,33,333 = 3S/10$$

$$\text{or } 10S - 13,33,330 = 3S \quad \text{or } S = \text{Rs. } 1,90,476$$

(b) IInd year

Revised Sales in IInd year = Rs. 1,90,476

Margin of Safety 40% (Given) = 76,190

New Break-even Sales = 1,14,286

(c) Break-even Sales = P/V ratio × Fixed cost

$$1,14,286 \times 3/10 = \text{Fixed cost}$$

Revised Fixed Cost = Rs. 34,286 Approx.

(d) Sales = Rs. 1,90,476

Variable Cost = 1,33,333

Contribution = 57,143

Fixed cost = 34,286

Profit = 22,857

Profitability of two Machines (Break-Even Analysis)

Problem 9.22 Y Company has just been incorporated and plans to produce a product that will sell for Rs. 10 per unit. Preliminary market surveys show that demand will be around 10,000 units per year.

The Company has the choice of buying one of two machines, each of

which has a capacity of 10,000 units per year. Machine 'A' would have fixed costs of Rs. 30,000 per year and would yield a profit of Rs. 30,000 per year on the sale of 10,000 units. Machine 'B' would have fixed costs of Rs. 18,000 per year and would yield a profit of Rs. 22,000 per year on the sale of 10,000 units.

Variable costs behave linearly for both machines. Required :

- Break-even sales for each machine.
 - Sales level where both machines are equally profitable.
 - Range of sales where one machine is more profitable than the other.
- (I.C.W.A. Final, June 1985 & I.C.W. 4. Inter, June 1987; C.S. Inter June 1989)*

Solution : In the present problem, sales, fixed overhead and profit are given. From this information variable cost can be arrived at :

	<i>Machine A</i>	<i>Machine B</i>
Fixed cost	Rs. 30,000	Rs. 18,000
Profit	30,000	22,000
Contribution	60,000	40,000
Sales (10,000 × Rs. 10)	1,00,000	1,00,000
Variable cost (Sales - Contribution)	40,000	60,000
P/V Ratio	60%	40%
Variable cost per unit	4.00	6.00
Contribution per unit	6.00	4.00

$$(a) \text{ Break-even sales} = \frac{\text{Fixed cost}}{\text{Contribution per unit}}$$

$$\text{For Machine A} = 30,000 \div 6 = 5,000 \text{ units or Rs. 50,000}$$

$$\text{For Machine B} = 18,000 \div 4 = 4,500 \text{ units or Rs. 45,000}$$

(b) Sales level where both the machines are equally profitable.

It is now a question of finding out cost indifference point, i.e., the point at which total cost of the two given machines will be equal. At this point profitability of the two machines will be equal. Suppose sales at which cost indifference point occurs is equal to x . Therefore, at this level total cost will be the same, viz.

$$\text{Rs. } 30,000 + 4x = \text{Rs. } 18,000 + 6x \text{ or } x = 6,000 \text{ units}$$

Proof

	<i>Data of 6,000 units</i>	
	<i>Machine A</i>	<i>Machine B</i>
Sales	Rs. 60,000	Rs. 60,000

V. Cost	24,000	35,000
Contribution	36,000	24,000
Fixed Cost	30,000	18,000
Profit	6,000	6,000

(c) It is clear from (b) that at the level of 6,000 units, both the machines are equally profitable. Contribution per unit of *A* is more than *B*, but fixed cost of *A* is also more than *B*. Advantage of higher contribution per unit of *A* will be realised after recovery of fixed cost of *A*, i.e., Rs. 30,000. Therefore, up to 6,000 units '*B*' is more profitable. After 6,000 units *C* is more profitable. To support the above, profitability of the two machines at two different levels (5,000 units and 7,000 units) is given below :

	5,000 units		7,000 units	
	<i>A</i> *	<i>B</i> **	<i>A</i>	<i>B</i>
Contribution	30,000	20,000	42,000	28,000
Less: Fixed Cost	30,000	18,000	30,000	18,000
Profit	—	2,000	12,000	10,000

*Rs. 6 per unit ; ** Rs. 4 per unit

Therefore, up to 6,000 units, *B* is more profitable than *A* due to lower fixed cost. However, beyond 6,000 units *A* is more profitable than *B* due to better P/V Ratio.

Costs and Profit of Two Products for Exports Quotation

***Problem 9.23.** Amongst its products a chemical company markets two concentrated liquid fertilizers—type *P* for flowers and type *Q* for vegetables. In 1987 total sales are expected to be restricted by forecast sales of type *Q* which are limited to 5,70,000 litres for the year. At this level the plant capacity will be under-utilised by 20%.

The fertilizers are manufactured jointly as follows :

Mixing. Raw materials *A* and *B* are mixed together in equal amounts and filtered. After filtering there is a saleable residue *X*, amounting to 5% of the input materials.

Distillation. The mixed materials are heated and there is an evaporation loss of 10%. The remaining liquid distils into one-third each of an extract *P*, an extract *Q* and a by-product *Y*.

Blending. Two parts of raw material *C* are blended with one part of extract *P* to form the fertilizer type *P*. One part of raw material *D* is blended with one part of extract *Q* to form the fertilizer type *Q*.

Fertilizer type *P* is filled into 3-litre cans and labelled. Fertilizer type *Q* is filled into 6-litre pre-printed cans. Both are then ready for sale.

The costs involved are as under :

<i>Raw material</i>	<i>Cost per 100 litres</i>
<i>A</i>	Rs. 25
<i>B</i>	12
<i>C</i>	20
<i>D</i>	55
<i>Cans</i>	<i>Cost each</i>
3-litre	Re 0.32
6-litre	0.50
<i>Labels</i>	<i>Cost per 1 000</i>
For 3-litre cans	Rs. 3.33

Manufacturing costs :

	<i>per 100 litres of input processed</i>		<i>Fixed overhead per year</i>
	<i>Direct wages</i>	<i>Variable overhead</i>	
Mixing	Rs. 1.75	Rs. 1.00	Rs. 6,000
Distilling	3.00	2.00	20,000
Blending	5.00	2.00	14,250

The residue *X* and by-product *Y* are both sold to local companies at Re. 0.03 and Re. 0.04 per litre respectively. Supplies are collected in bulk by the buyers using their own transport. The sales revenue is credited to the process at which the material arises.

Product costs are apportioned entirely to the two main products on the basis of their output from each process.

No inventories of part finished materials are held at any time.

The fertilizers are sold through agents on the basis of list price less 25%. Of the net selling price, selling and distribution costs amount to 13½% and profit to 20%. Of the selling and distribution costs 70% are variable and the remainder fixed.

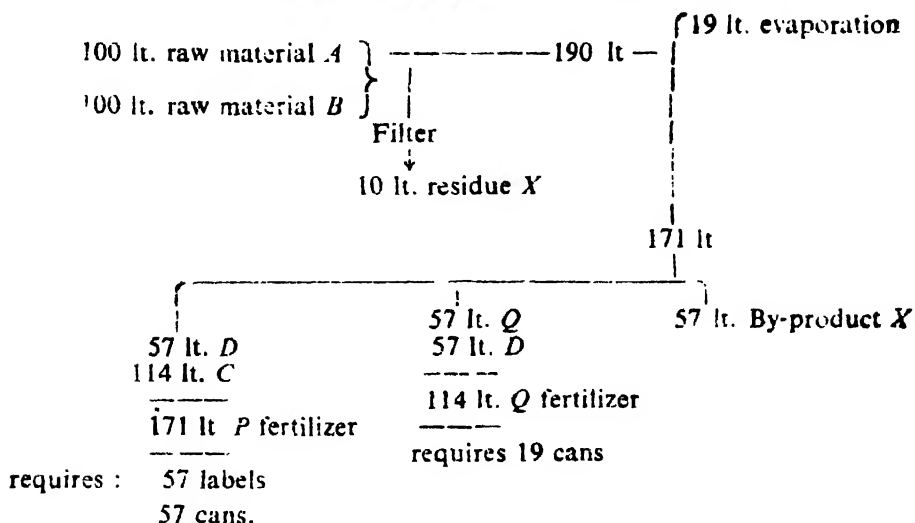
You are required to :

(a) Calculate separately for the fertilizers type *P* and type *Q* for the year 1987 :

(i) total manufacturing cost, (ii) manufacturing cost per litre, (iii) list price per litre, (iv) profit for the year.

(b) Calculate the break-even price per litre to manufacture and supply an extra 50,000 litres of fertilizer type *Q* for export and which would incur variable selling and distribution costs of Rs. 2,000.

(I.C.M.A., London, Nov. 1985 Adapted)

Solution : (a) Schematic Diagram of Process of One Lot

Variable Cost Per Lot

		Fertilizer P	Fertilizer Q
Raw Material A	100 lt. × 25% = Rs. 25.00	Rs.	Rs.
Raw Material B	(100 lt. × Rs. 12)/100 = Rs. 12.00		
	37.00		
Mixing	(200 lt. Rs. 3.75)/100 = 7.50		
Blending	(190 lt. Rs. 5.00)/100 = 9.50		
	54.00		
Less : Credits from sale			
10 lt. of 'X'	Re. 0.03 = Re. 0.30		
57 lt. of 'Y'	Re. 0.04 = Rs. 2.28		
	2.58		
	51.42		
		25.71	25.71
Raw Material C	(114 lt. × Rs. 20)/100 = 22.80		
Raw Material D	(57 lt. × Rs. 55)/100 = 31.35		
Blending	171 × 7/100 = 11.97		
	114 × 7/100 = 7.98		
Labels/Cans	57 × Re. 0.32 = 18.24		
	57 × 3.33/1,000 = 0.19		
	19 × Re. 0.50 = 9.50		
	78.91		74.54

Output = 5,70,000 litres ÷ 114 litre per lot = 5,000 lots.

	Fertilizer P	Fertilizer Q
(i) Total Variable Cost	Rs.	Rs.
5,000 × Rs. 78.91	3,94,550	
5,000 × Rs. 74.54		3,72,700
Mixing and Distilling (Rs. 6,000 + Rs. 20,000)	13,000	13,000
Blending $\frac{171 \text{ lt.}}{*285 \text{ lt.}}$ Rs. 33,250	19,950	
Weight blended $\frac{114 \text{ lt.} \times \text{Rs. } 33,250}{*285 \text{ lt.}}$		13,300
Total manufacturing cost	<u>4,27,500</u>	<u>3,99,000</u>
*total quantity blended.		
(ii) Total quantity produced		
171 lt. × 5,000 lots	8,55,000 lt.	
114 lt. × 5,000 lots		5,70,000 lt.
Manufacturing cost per litre		
Rs. $4,27,500 \div 8,55,000 \text{ lt.}$	Re. 0.50	
Rs. $3,99,000 \div 5,70,000 \text{ lt.}$		Re. 0.70
	Variable component	
(iii) Suppose list price	= Rs. 100	Rs.
∴ Net selling price	= 75	
Profit 0.2 × 75	= 15	
Total Cost	= 60	60
Selling and Distribution 13.33×0.75	= 10	7
Manufacturing Cost	<u>50</u>	<u>53</u>

Based on the relationship of manufacturing cost and list price determined above.

	Fertilizer P	Fertilizer Q
List price per litre	Re. 1.00	Rs. 1.40
(iv) Profit for the year		
$15 \div 50 \times 4,27,500$	Rs. 1,28,250	
$15 \div 50 \times 3,99,000$		Rs. 1,19,700

b) Break-even :

Variable Cost for 50,000 litres of fertilizer Q	
Rs. $3,72,700 \div 5,70,000 \times 50,000$	= Rs. 32,693
Additional Variable Cost	2,000
	<u>34,693</u>

Less : Contribution on P for this addition
50,000 litre of Q

Due to 50,000 litre of Q, production of P will be
 $171 \div 114 \times 50,000 = 75,000$ litre

Total units of P produced :

$$171 \div 114 \times 5,70,000 = 8,55,000 \text{ litres}$$

\therefore Variable cost per litre of P

$$\text{Rs. } 3,94,550 \div 8,55,000$$

Rs. 0.46

S and D cost per litre for P $7 \div 50 \times 0.46$

0.064

Total Variable Cost

0.524

Selling Price of P per litre

0.750

Contribution

0.226

\therefore Total contribution on 75,000 litres

$$75,000 \times 0.226$$

Rs. 16,950

Net Variable Cost for 50,000 lt. of Q

17,743

\therefore Net Cost = Rs. $17,743 \div 50,000$

= Re. 0.355 per litre—Break-even price.

BREAK-EVEN CHARTS

Problem 9-24. You are given the following data for the coming year of a factory.

Budgeted output (units)

80,000

Fixed expenses

Rs. 4,00,000

Variable expenses per unit

10

Selling price per unit

20

Draw a break-even chart showing the break-even point.

If the selling price is reduced to Rs. 18 per unit, what will be the new break-even point? (I.C.W.A. Inter)

Steps Required :

Chart can be drawn based on following steps :

1. Output is 80,000 units. It should be plotted on OX. X represents sale of 80,000 units.

2. Fixed expenses are Rs. 4,00,000. A point F should be placed on OY representing fixed expenses. FY' represents fixed cost line.

3. Place point on OY axis representing total cost of 80,000 units (*i.e.*, Rs. 4,00,000 fixed cost + Rs. 8,00,000 = Rs. 12,00,000).

4. Place point S' representing Rs. 16,00,000, *i.e.*, sales of 80,000 units.

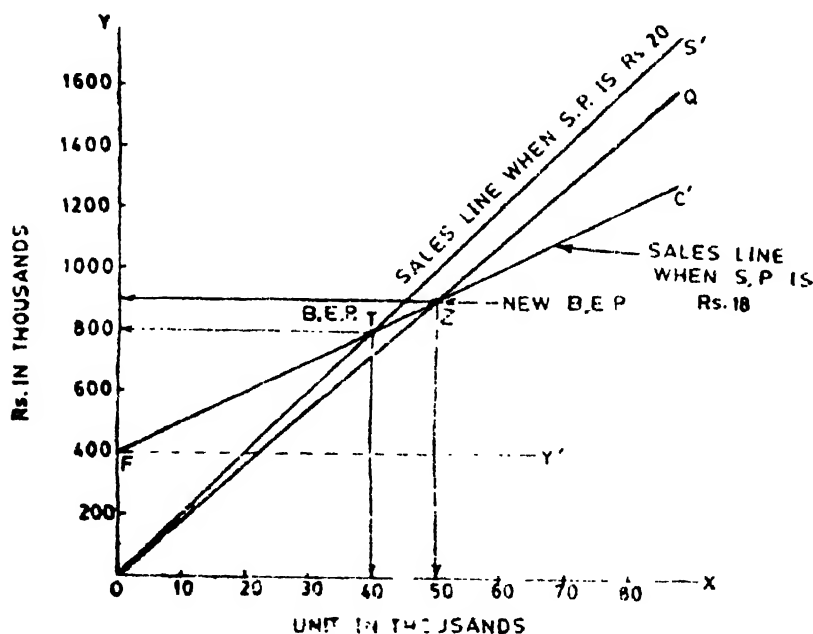
5. Join OS' (*i.e.*, sales line). Join FC' (total cost line). OS' and FC' intersect each other at T which is the break-even point.

At T , *i.e.*, break-even point sale in units is 40,000 and sale in rupees is Rs. 8,00,000.

6. When the selling price is reduced to Rs. 18.

The total sales will be Rs. 14,40,000 (*i.e.*, 80,000 \times Rs. 18). Place a point Q representing sales of Rs. 14,40,000 for 80,000 units. Join OQ . This will be the new sales line. OQ and FC' intersect each other at point Z , which represents new break-even point (*i.e.*, sale level of 50,000 units and sale of Rs. 9,00,000).

Solution :



Break-even Chart

Sequential Profit Graph

Problem 925. The following figures apply to a manufacturing company producing a wide range of products which may be classified into three main groups :

Product Group	Annual Sales	Variable Cost
A	Rs. 30,00,000	Rs 10,00,000
B	30,00,000	20,00,000
C	35,00,000	30,00,000

7. Draw a line joining Y', A, B and C. This represents profit path.
8. Join Y'C. This represents total profit line.

Profit/Volume Graph—Use of Probability

Problem 9'2b. Your company has just developed a new micro-computer to compete in the rapidly expanding home market. As management accountant, you are consulted as to the viability of marketing this computer.

In conjunction with the manager of research and development, the production manager, the buyer and the sales manager, you have been able to ascertain the following estimates :

<i>Sales level (units)</i>	<i>Profit (Rs.)</i>
12,000	(30,000)
15,000	1,50,000
18,000	3,30,000

The selling price will be Rs. 150.

You are required to :

(a) prepare a contribution/sales graph (sometimes known as a profit/volume graph), using the information given above, and read off the margin of safety.

(b) calculate the estimated profit if the probabilities for each sales level are :

<i>Sales level (units)</i>	<i>Probability</i>
12,000	0.2
15,000	0.5
18,000	0.3
	<hr/> 1.0

(I.C.M.A. London, Nov. 1985, Adapted)

Solution :

(a) For preparation of contribution to sales (or profit/volume) graph, it is necessary to ascertain fixed costs.

$$\text{P/V ratio} = \frac{\text{Change in Profit}}{\text{Change in Sales}}$$

<i>Sales level units</i>	<i>Sales Rs.</i>	<i>Difference in Sales Rs.</i>	<i>Profit Rs.</i>	<i>Difference in Profit Rs.</i>
12,000	18,00,000	—	(30,000)	—
15,000	22,50,000	4,50,000	1,50,000	1,80,000
18,000	27,00,000	4,50,000	3,30,000	1,80,000

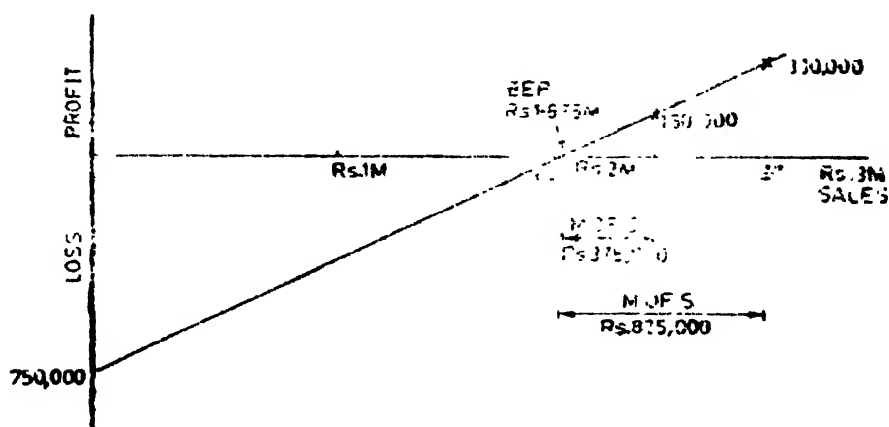
$$\therefore \text{P/V ratio} = \frac{\text{Rs. } 1,80,000}{4,50,000} \times 100 = 40\%$$

∴ Variable cost is 60% of selling price (60% of Rs. 150) or Rs. 90 per unit.

The sales and cost structure for each of the three levels of sales are :

Units	12,000	15,000	18,000
Sales in rupees	18,00,000	22,50,000	27,00,000
Variable cost	10,80,000	13,50,000	16,20,000
Contribution	7,20,000	9,00,000	10,80,000
Fixed cost (Balancing figure)	7,50,000	7,50,000	7,50,000
Profit (Given)	(30,000)	1,50,000	3,30,000

This data is plotted on graph as follows :



This Graph shows :

- Break-even sales at Rs. 18,75,000.
- Margin of safety of Rs. 3,75,000, if sales are Rs. 22,50,000 (15,000 units)
- Margin of safety of Rs. 8,25,000, if sales are Rs. 27,00,000 (18,000 units).

(b) Expected value of sales at probabilities given :

Units		Probability		Units
12,000	×	0.2	=	2,400
15,000	×	0.5	=	7,500
18,000	×	0.3	=	5,400
		<u>1</u>		<u>15,300</u>

Statement showing Profit at a Sales level of 15,300 Units

Sales (15,300 × Rs. 150)	Rs. 22,95,000
Variable cost (15,300 × Rs. 90)	13,77,000
Contribution	9,18,000
Less : Fixed costs	7,50,000
Profit	1,68,000

KEY FACTORS**Closure of a Product Line—Raw Material being Key Factor**

Problem 9-27. A Ltd. manufactures three products and the cost particulars for a year are as follows :

	<i>Product</i>		
	<i>X</i>	<i>Y</i>	<i>Z</i>
	Rs.	Rs.	Rs.
Sales	2,00,000	4,00,000	2,50,000
Material	1,00,000	1,50,000	1,25,000
Labour cost	30,000	50,000	40,000
Variable overhead	10,000	20,000	25,000
Fixed overhead	35,000	50,000	25,000

The company imports one of the raw materials which is used in manufacture of all products. The consumption of material is as follows :

X—2,000 kg.
Y—5,000 kg.
Z—3,000 kg.

There is restriction on import of the material. The management is planning to close down one of the lines of product, and utilize the material for other two lines to improve the profitability. As the Secretary of the company, prepare a report for the closure of one line for improving the profitability.

(CS. Inter, Dec. 1986)

Solution : Statement showing Profitability of Products XYZ

	<i>X</i>	<i>Y</i>	<i>Z</i>
Sales	2,00,000	4,00,000	2,50,000
Material cost	1,00,000	1,50,000	1,25,000
Labour cost	30,000	50,000	40,000
Variable cost	10,000	20,000	25,000
Marginal cost	1,40,000	2,20,000	1,90,000

Contribution	60,000	1,80,000	60,000
Imported material	2,000 kg.	5,000 kg.	3,000 kg.
Contribution per kg. of imported material	Rs. 30	Rs. 36	Rs. 20

Contribution per kg. of material is minimum in case of Z. Hence manufacture of Z may be discontinued and this raw material should be utilized to manufacture Y, which gives maximum contribution per kg. of material.

Marginal Costing (Limiting Factor)

Problem 9.28. Domestic political trouble in the country of an overseas supplier is causing concern in your company because it is not known when further supplies of raw material 'x' will be received. The current stock held of this particular raw material is 17,000 kilogrammes which costs Rs. 1,36,000. Based on raw material 'x', your company makes five different products and the expected demand for each of these, for the next three months, is given below together with other relevant information :

Product code	Kilogramme of raw material 'x' per unit of finished product Kg	Direct labour hours per unit of finished product Hours	Selling price per unit Rs.	Expected demand over three months Units
701	0.7	1.0	26	8,000
702	0.5	0.8	28	7,200
821	1.1	1.5	34	9,000
822	1.3	1.1	38	12,000
937	1.5	1.2	40	10,000

The direct wages rate per hour is Rs. 5 and production overhead is based on direct wages cost—the variable overhead absorption rate being 40% and the fixed overhead absorption rate being 60%. Variable selling costs, including sales commission, are 15% of selling price.

Budgeted fixed selling and administration costs are Rs. 3,00,000 per annum. Assume that the fixed production overhead incurred will equal the absorbed figure.

You are required to :

- show what quantity of the raw material on hand ought to be allocated to which products in order to maximise profits for the forthcoming three months.
- present a brief statement showing contribution and profit for the forthcoming three months, if your suggestion in (a) is adopted ;

- (c) comment briefly on the analysis you used to aid the decision-making process in (a) and give three other examples of business problems where this type of analysis can be useful.

(C.I.M.A. London, Nov. 1987)

Solution. (a) Statement showing Products Profitability

	701	702	821	(Rs. per unit)	
	701	702	821	822	937
Selling Price	26.00	28.00	34.00	38.00	40.00
Less : Variable Cost :					
Raw material	5.60	4.00	11.20	10.40	12.00
Direct wages	5.00	4.00	7.50	5.50	7.00
V. Production overhead	2.00	1.60	3.00	2.20	2.80
Variable selling costs	3.90	4.20	5.10	5.70	6.00
Contribution per unit	9.50	14.20	7.20	14.20	12.20
Contribution per kg. of					
RM consumed	13.57	28.40	5.14	10.92	8.13
Ranking	2	1	5	3	4
Allocation of Material for each product :					

Code	Expected demand (units)	Consumption (kg./unit)	Material required [*] (kg.)
702	7,200	0.5	3,600
701	8,000	0.7	5,600
822	6,000*	1.3	7,800* (balancing figure)
			17,000

* $7,800 \div 1.3$

(b) Profitability for the 3 months

Total contribution :	702	7,200 × Rs. 14.20 =	Rs. 1,02,240
	701	8,000 × Rs. 9.50 =	76,000
	822	6,000 × Rs. 14.20 =	85,200
			2,63,440
Less : Fixed Costs . Production	7,200 × Rs. 2.40 =	17,280	
	8,000 ×	3.00 =	24,000
	6,000 ×	3.30 =	19,800
Selling @ $\frac{1}{4} \times$ Rs. 3,00,000		75,000	1,36,080
Profit			1,27,360
@ for 3 months			== == ==

Adding a Product line (Machine Hours being Limiting Factor)

Problem 9 29. Something More Ltd. is considering adding to its product line. After a lot of deliberations between the Sales and Production Personnel, it is decided that products *P*, *Q* and *R* would be the most desirable additions to the company's product range on account of the technical competency, marketing potential and production flexibility as regards these products. In fact *P*, *Q* and *R* can all be made on the same kind of plant as that already in use and therefore as regards production, all products can be readily interchanged. However, it is considered necessary to build further plant facilities to cater for additional production.

In this connection the following data are relevant :

<i>Products (Per Unit)</i>	<i>P</i>	<i>Q</i>	<i>R</i>
Direct Materials	Rs. 100	Rs. 120	Rs. 90
Direct Labour	50	70	90
Variable Overheads	50	130	100
Selling Price	350	420	370
Demand in units per cost period (on the basis of the above selling price)	200	125	750
Machine Hours required per unit of production	15	5	3

It is felt that initially extra plant facilities can be built to operate at the following five different levels of activity, viz., 1,800, 2,300, 2,800, 3,300 and 3,800 machine hours per cost period. The fixed overhead costs for a cost period relevant to these five different levels of activity are estimated at Rs. 15,000, Rs. 20,000, Rs. 26,000, Rs. 33,000 and Rs. 39,000 respectively.

You are required to advise, with supporting figures, the product or products to be manufactured and in what quantities at each of the five contemplated levels of activity in order to maximize the profits at each level and also indicate the level of activity that would seem most desirable to be pursued for such maximization of profits. (C.A. Final, May 1983)

Solution :

Statement showing Contribution per unit and Contribution per hour, and Priority Based on Contribution per hour

	<i>P</i>	<i>Q</i>	<i>R</i>
Selling Price per unit	Rs. 350	Rs. 420	Rs. 370
Variable Cost :			
Direct material	100	120	90
Direct labour	50	70	90
Variable overheads	50	130	100
Marginal cost	200	320	280

Contribution	150	100	90
	<hr/>	<hr/>	<hr/>
Hrs. required for one unit	15	5	3
	<hr/>	<hr/>	<hr/>
Contribution per hour	10	20	30
	<hr/>	<hr/>	<hr/>
Priority based on contribution per hour	3rd	2nd	1st

(See table on next page)

Product Mix (Imported Raw Material being Key Factor)

***Problem 9.30.** On a turnover of Rs. 20 crores in 1984, a large manufacturing company earned a profit of 10% before interest and depreciation which were fixed. The product mix was as under :

Products	Mix % to total sales	P/V ratio %	Raw material as % on Sales value
P	10	30	40%
Q	30	20	35%
R	20	40	50%
S	40	10	60%

Interest and depreciation amounted to Rs. 150 lacs and Rs. 77 lacs respectively.

Due to fluctuations in prices in the International Market, the company anticipates that the cost of raw materials which are imported will increase by 10% during 1985. The company has been able to secure a licence for the import of raw materials of a value of Rs. 1,023 lacs at 1985 prices. In order to counteract the increase in costs of raw materials the company is contemplating to revise its product mix. The market survey report recently prepared indicates that the sales potential of each of the products P, Q and R can be increased up to 30% of the total sales value of 1984. There is no inventory of finished goods or work-in-process in both the years. Required :

- Set an optimal product mix for 1985 and find the profitability.
- What percentage increase in overall price is required in 1985 to raise the sales value to maintain the margin of safety at 10%.

(C.A. Final. May 1985)

(Refer to page 9.54 for solution)

SOMETHING MORE LTD

Statement showing Production of P, Q, R, Based on Contribution per Unit

Level of activity (in hours)	Product P (Maximum unit = 200 Maximum hrs. to be utilized $200 \times 15 = 3,000$ hours)			Product Q (Maximum units = 125 Maximum hrs. to be utilized $125 \times 5 = 625$ hours)			Product R (Maximum units = 750 Maximum hrs. to be utilized $750 \times 3 = 2,250$ hours)			Total Contri- bution Rs.	Fixed Cost Rs.	Profit Rs.
	Hrs. used	Units pro- duced	Contri- bution made	Hours used	Units produced	Contri- bution made	Hours used	Units pro- duced	Contri- bution made			
1,800			Rs.			Rs.	1,800	600	Rs. 54,000	54,000	15,000	39,000
2,300				50	10	1,000	2,250	750	67,500	68,500	20,000	48,500
2,800				550	110	11,000	2,250	750	67,500	78,500	26,000	52,500
3,300	420 5*	28	4,200	625	125	12,500	2,250	750	67,500	84,200	33,000	51,200
3,800	915 10*	61	9,150	625	125	12,500	2,250	750	67,500	89,150	39,000	50,150

* These hours are used to produce incomplete units for which profit will be realised only in next period (year or quarter). These hours are to be disregarded for profit for this period.

Comments : Maximum profit of Rs. 52,500 will be made when 750 units of R and 110 units of Q are produced

(From page P952)

Solution :**(a) Statement showing Original and Revised Material Cost**

Product	Mix % to total sales	Sales (Rs. lacs)	Raw material as % on sales value	Existing cost of raw material	Increased cost of raw material after 10% increase
P	10	200	40	80	88
Q	30	600	35	210	231
R	20	400	50	200	220
S	40	800	60	480	528
		2,000		970	1,067

(b) Statement showing other Variable Cost

Products	Sales Rs. lacs	Existing P/V ratio %	Variable cost	Less mate- rial cost	Other variable cost
P	200	30	140	80	60
Q	600	20	480	210	270
R	400	40	240	200	40
S	800	10	720	480	240
	2,000		1,580	970	610

(c) Statement showing Contribution to Material Ratio and Ranking of Products on this Basis

(Rs. in lacs)

Pro- ducts	Sales	Other vari- able cost	Re- vised mate- rial cost	Total vari- able cost	Contri- bution (Sales- variable cost)	P/V ratio	Contri- bution to mate- rial ratio	Ranking based on contri- bution to sales
P	200	60	88	148	52	26%	59.09%	II
Q	600	270	231	501	99	16.5%	42.86%	III
R	400	40	220	260	140	35%	63.64%	I
S	800	240	528	768	32	4%	6.06%	IV
	2,000	610	1,067	1,677	323			

(d) Statement showing Maximum Sales Potential of Individual Products*(Rs. in lacs)*

P	30% of Rs. 2,000	600
Q	30% of Rs. 2,000	600
R	30% of Rs. 2,000	600
S	40% of Rs. 2,000	800

(e) Allocation of Raw Material Based on Contribution to Sales Ratio

Product	Rank	Sales Rs. in lacs	Material required	Working for determining value of material required	Balance raw material Rs. in lacs
Balance Raw Material					1,023
R	I	600	330	$\left(\frac{220}{400} \times 600 \right)$	693
P	II	600	264	$\left(\frac{88}{200} \times 600 \right)$	429
Q	III	600	251	$\left(\frac{231}{600} \times 600 \right)$	398
S	IV	800	198		Nil
					1,023

(f) Total Contribution in 1984

Product	Sales (Rs. in lacs)	P/V ratio %	Contribution (Rs. in lacs)
P	200	30	60
Q	600	20	120
R	400	40	160
S	800	10	80
	2,000		420

***Hint for finding out contribution**

$$(S - V)/S = P/V \text{ ratio}$$

$$\text{or Contribution} = P/V \text{ ratio} \times \text{Sales}$$

$$200 \times 30\% \text{ or } 60.$$

(g) Computation of Fixed Overhead

Present turnover		Rs. 2,000 lakhs
Profit 10% of sales		200
Less : Interest	150	
Depreciation	77	
		227
Net loss		27

It means net loss in 1984 was Rs. 27 lacs.

Total contribution in 1984 was Rs. 420 lacs.

It leads to conclusion that contribution must have fallen short of fixed overhead by Rs. 27 lacs.

$$\therefore \text{Fixed overheads} = \text{Contribution in 1984} + \text{Loss} \\ = \text{Rs. } 420 + 27 \text{ or Rs. } 447 \text{ lacs.}$$

(i) Optimum Mix and Profitability

Product	Optimum sales Rs. in lacs	Revised P/V ratio %	Contribution* Rs. in lacs
P	600	26	156
Q	600	16.5	99
R	600	35	210
S	300	4	12
	2,100		477
Less : Fixed cost			447
Profit			30

$$*(S - V)/S = P/V \text{ ratio}$$

$$\text{Contribution} = \text{Sales} \times P/V \text{ ratio} \\ = 600 \text{ lacs} \times 26\% \text{ or } 156 \text{ lacs.}$$

(ii) Required Percentage Increase in Overall Price in 1985

We know that : $(S - V)/S = P/V \text{ ratio}$

or $\text{Contribution} \div \text{Sales} = P/V \text{ ratio}$

$$\text{BES} = \text{Fixed Cost} \div P/V \text{ Ratio}$$

$$= \frac{447}{(477 \div 2,100)} \text{ or Rs. } 1,967.92 \text{ lacs.}$$

Margin of safety required is 10%

∴ If Sales = 100

Margin of safety = 10

B.E. sales = 90

∴ If B.E. sales is 90, required sales for 10% margin of safety = 100

If BES is 1,967.92 the required sales for 10% margin of safety will be = $1,967.92 \text{ lacs} \div 90\%$ or Rs 2,186.58 lacs

∴ Sales value increase required

= 2,186.58 lacs – 2,100 lacs or Rs. 86.58 lacs

∴ Required percentage increase in sales price

= $86.58 \div 2,100 \times 100$ or 4.12%.

Maximisation of Profit with two Constraints

Problem 9.31. Akshara Combines manufactures 3 components X, Y and Z, which are made up from 3 parts A, B and C in the following proportions

X	1 A and 1 B
Y	2 A, 2 B and 1 C
Z	3 A, 1 B and 2 C.

These parts are made on the premises. Further information is as follows :

	A	B	C
Selling price	Rs. 6	Rs. 14	Rs. 24
Direct materials	2	2	5
Time cost	2	9	12

'Time cost' which covers the cost of Direct Labour and Overheads is valued at Rs. 6 per hour. All parts can be sold individually at the above selling prices, but the market demand, which it is hoped, will be satisfied from the expansion will be for the components. The further expansion would provide an additional 58,000 hours and the additional market demand for the components would be 5,000 units each. Additional fixed expenses related to the expansion are expected to be Rs. 15,000.

Prepare a statement showing how the additional capacity available should be used to generate maximum additional profit.

(I.C.W.A. Final, June 1984)

Solution : Three components X, Y and Z are made up from three parts A, B and C in different proportions. Two constraints given are 58,000 hours and market demand for the components of 5,000 units each. Therefore, contribution per hour should be determined as under :

Component		X	Y	Z
1. Selling Price per unit				
A	B	C		
1 : 1	—	(6 × 1 + 14 × 1)	Rs. 20	
2 : 2 : 1		(6 × 2 + 14 × 2 + 24 × 1)	Rs. 64	
3 : 1 : 2		(6 × 3 + 14 × 1 + 24 × 2)		Rs. 80
		— — —	— — —	— — —
2. Variable cost				
Direct materials		2 + 2 = 4	4 + 4 + 5 = 13	6 + 2 + 10 = 18
Time cost		2 ÷ 9 = 11	4 ÷ 18 = 12 = 34	6 ÷ 9 + 24 = 39
Total		15	47	57
3. Contribution (1 - 2)		5	17	23
4. Hours required per unit (Time cost ÷ Hourly rate Rs. 6) 11/6 hr.				
			34/6 hr.	39/6 hr.
5. Contribution per hour (3 - 4) Rs. 2'73				
			Rs. 3'00	Rs. 3'54
Ranking		III	II	I

**Statement showing the Profitability of the Components
by Utilizing 58,000 Available hours**

Component	Demand in units	Hours per unit	Total hours	Contribution per unit	Total contribution
Z	5,000	39/6	32,500	Rs. 23	Rs. 1,15,000
Y	4,500*	34/6	25,500	17	76,500
			58,000		
Total Contribution					1,91,500
Less : Additional fixed expenses					15,000
Net profit (Maximum)					1,76,500

* 25,500 ÷ 34/6.

Maximisation of Profit with two Key Factors

***Problem 9'32.** Z Ltd., makes a range of five products to which the following standards apply :

	Per Unit				
	A	B	C	D	E
Sales Price	Rs. 50	Rs. 60	Rs. 70	Rs. 80	Rs. 90
Direct materials	9	10	17	12	21
Direct wages	16	20	24	28	32
Variable production overheads	8	10	12	14	16
Variable selling and distribution overheads	5	6	7	8	9
Fixed overheads	4	5	6	7	8
	42	51	66	69	86

The direct labour wage rate is Rs. 4 per hour. Fixed overheads have been allocated on the basis of direct labour hours. The Company has commitments to produce a minimum of 400 units of each product per month; direct labour hours cannot exceed 13,000 per month due to restriction of space. The Board is now considering an offer of a new three-year contract to produce an additional 400 units of product B per month at a selling price of Rs. 58 per unit. The contract would involve an outlay of Rs. 1,00,000 on the lease of additional factory premises and purchase of new plant and equipment. There would be no residual value at the end of the contract. Variable production costs would be in accordance with existing standards, variable selling and distribution costs would be one-half of the existing rate and cash outflows on fixed costs would be Rs. 20,000 per annum. There would be no changes to existing production arrangements. An outside supplier has offered to supply 400 units of product B per month at a price of Rs. 48 per unit. If purchased externally cash flows on additional fixed costs will be Rs. 25,000 per annum. Required :

(a) Give recommendations, supported by calculations, to show how direct labour hours in the existing factory should be utilised in order to maximise profits.

(b) Show the budgeted trading results on the basis of your recommendation in (a).

(c) Give calculations to show whether or not the proposed contract for product B should be accepted and, if so, whether it should be purchased externally or manufactured in the new premises. The Company's cost of capital is 10% (the present value of an annuity of Re. 1 for three years at 10% is Rs. 2.49). Ignore taxation and inflation.

(I.C.W.A. Final, June 1987)

Total Contribution

	Units \times Contribution per unit	Rs.
A	$7,800 \times 12 = 93,600$	
B	$4,800 \times 14 = 67,200$	
C	$4,800 \times 10 = 48,000$	
D	$4,800 \times 18 = 86,400$	
E	$4,800 \times 12 = 57,600$	
	<hr/>	3,52,800
Less : Fixed overheads		1,56,000
		<hr/>
Profits		1,96,800

(c) Cost-Benefit Analysis will be done for both the proposals. Benefit in both the proposals will be selling price of 4,800 units of B at price of Rs. 58, i.e., Rs. 2,78,400 for three years. Since costs are incurred at various points of time, the present value will be taken for comparing the alternatives.

(d) Whether or not proposed contract for Product B should be accepted

Proposal I—If 400 units are manufactured

Selling price per unit	= Rs. 58	
Variable cost per unit	= Rs. 43	
	<hr/>	
	15	
	<hr/>	
Contribution during 1 year	$= 15 \times 400 \times 12 =$ Rs.	72,000
Less : Additional fixed cost	$=$	20,000
		<hr/>
Annual inflow due to manufacturing in one year		52,000
		<hr/>
Present value of inflow in three years at the annuity factor given Rs. 52,000 \times Rs. 2.49	$=$ Rs.	1,29,480
Less : Initial cash outflow	$=$ Rs.	1,00,000
		<hr/>
Net advantage		29,480
		<hr/>

Proposal II – Buying Product B from Outside @ Rs. 48 per Unit**Cost**

Purchasing cost ($4,800 \times 48$)	2,30,400
Annual cash outlay on F.C	25,000
	<hr/>
	2,55,400
	<hr/>
Present value of cost for 3 years ($2,55,400 \times 2.49$)	6,35,946
	<hr/>

Benefit

Sale volume (4,800 × 58)	2,78,400
Total sales for 3 years (present value)	6,93,216
Net Benefit (6,93,216 – 6,35,946)	57,270

Comment—Product *B* should be purchased externally. It will minimise the risk and avoid capital outlay.

**Maximisation of Profit considering Capacity Constraints—
Different Price Segments**

Problem 9'33. An export-oriented organisation sells in the Middle East three brands of their products, viz., Juvenile, Adult and Aged. The market for different price segments is as follows :

<i>Brand</i>	<i>Selling Price per 100 units</i>	<i>Market Demand units per Month</i>
Juvenile	Rs. 600	1,00,000
	550	1,20,000
	500	1,36,000
Adult	500	2,00,000
	475	2,20,000
	450	2,50,000
Aged	550	80,000
	525	96,000
	500	1,00,000

The capacity to pack and export is presently limited to 4 lakh units per month. The variable cost of production per unit is as follows :

	<i>Juvenile</i>	<i>Adult</i>	<i>Aged</i>
Raw material	Rs. 2'10	Rs. 1'50	Rs. 1'40
Packing material	1'60	1'00	1'00
Labour and expenses	0'62	0'58	0'57

Besides, trade discount is allowed @ 6% of Selling Price, out of which 1% is allowed to Overseas Agent. Variable distribution and handling charges amount to Rs. 12 per carton containing 50 units each. Export duty is payable 5 % *ad valorem*.

Export incentives, viz., cash subsidy, duty drawback, etc., amount to 16% of net selling price after considering only 1% discount allowed to the Overseas Agency.

You are required to find out the combination of the three products, which will yield maximum profit, considering capacity constraints.

(I.C.W.A. Final, June 1987)

Solution : Statement showing Contribution per unit for Different Brands and for Different Price Segments

Details	Juvenile			Adult			Aged
Market Demand per month units	1,00,000	1,20,000	1,36,000	2,00,000	2,20,000	2,50,000	96,000 1,00,000
1. Selling price per (unit)	6'00	5'500	5'00	5'00	4'750	4'500	5'500 5'00
2. Less : 1% discount to overseas agent	0'06	0'055	0'05	0'05	0'048	0'045	0'055 0'05
3. S.P. Less 1% discount	5'94	5'445	4'95	4'95	4'702	4'455	5'445 5'197
4. Less : 5% discount or S. No. 1	0'30	0'275	0'25	0'25	0'238	0'225	0'275 0'25
5. Net S.P.	5'64	5'170	4'70	4'70	4'464	4'23	5'170 4'935
Variable Costs :							
Raw materials	2'10	2'10	2'10	1'50	1'50	1'50	1'40 1'40
Packing materials	1'60	1'60	1'60	1'00	1'00	1'00	1'00 1'00
Labour and expenses	0'62	0'62	0'62	0'58	0'58	0'58	0'57 0'57
Distribution and handling (Rs. 12 ÷ 50)	0'24	0'24	0'24	0'24	0'24	0'24	0'24 0'24
Excise duty (5% of S.P.)	0'30	0'275	0'25	0'25	0'238	0'225	0'275 0'25

Total variable costs	4.86	4.835	4.81	3.57	3.558	3.545	3.473	3.460
Less: Export incentives (16% of item 3)	0.95	0.871	0.792	0.792	0.752	0.713	0.832	0.792
Net Variable costs	3.91	3.964	4.018	2.773	2.806	2.832	2.641	2.668
Contribution per unit (5-6)	1.73	1.206	0.682	1.927	1.658	1.398	2.294	2.032
Total contribution	1,73,000	1,44,720	92,752	3,84,400	3,64,760	3,49,500	2,20,224	2,03,200
Ranking based on total contribution	III	I	II					

Considering the capacity constraints, the most profitable combination will be as under :

Rank	Brand	Market Demand (Units)	Total Contribution
I	Adult	2,00,000	Rs. 3,84,400
II	Aged	96,000	2,20,224
III	Juvenile	1,00,000	1,73,000
	Total	3,96,000	7,77,624

EFFECT OF CHANGE IN COST, VOLUME & PRICE

Revised sales required for variation in costs/price

Problem 9.34. You are given the following data pertaining to a factory :

	<i>Present</i> (1986)	<i>Forecast</i> (1987)
Sales (in units)	10,000	15,000
Loss (in rupees)	5,000	—
Fixed cost (in rupees)	25,000	25,000
Profit (in rupees)	—	5,000

For the above working purposes variable cost of sales has been taken at Rs. 7 per unit up to 15,000 units and it shall be Rs. 8 per unit beyond 15,000 units.

You are required to state as to :

(i) What percentage of increase in sales is required to cover additional 50 paise per unit towards extra packaging cost in 1987 for achieving the additional sales target ?

(ii) What percentage of increase in sales is required to maintain budgeted profit with a price reduction of 25 paise per unit ?

(iii) What percentage of increase in sales is required to meet additional publicity expenses of Rs. 2,000 and also maintain the targeted profit ?

(iv) What is the maximum increase in fixed cost (additional depreciation) per period to justify the proposal for buying a new machine which will reduce variable cost of sales by Rs. 2 per unit at all levels ? Sales to remain at 10,000 units and the targeted profit to be achieved.

(The above situations have to be considered independently of each other.)
(C.S. Final, June 1987)

Solution :

Determination of selling price. We know that

$$S - V = F + P \text{ or } S - 70,000 = \text{Rs. } 25,000 - \text{Rs. } 5,000 \\ \text{or Sales} = \text{Rs. } 90,000$$

$$\therefore \text{Selling Price} = \text{Rs. } 90,000 \div 10,000 \text{ units} = \text{Rs. } 9.00 \text{ per unit.}$$

$$(i) \text{ Contribution required} = \text{Rs. } 25,000 - 5,000 = \text{Rs. } 20,000 \\ \text{Contribution by 15,000 units} = \text{Rs. } 15,000 \times (\text{Rs. } 9 - \text{Rs. } 7.50) \\ = \text{Rs. } 22,500$$

$$\text{Additional contribution required from additional units} \\ = \text{Rs. } 20,000 - \text{Rs. } 22,500 = \text{Rs. } 7,500.$$

Units required to earn contribution of Rs. 7,500 :

$$= \text{Rs. } 7,500 \div (\text{Rs. } 9.00 - \text{Rs. } 8.50) = 15,000 \text{ units}$$

$$\therefore \text{Proposed sales} = 15,000 + 15,000 = 30,000 \text{ units}$$

$$\therefore \text{Required increase in sales} = 30,000 - 10,000 = 20,000 \text{ units}$$

$$\therefore \text{Percentage increase required} = (20,000 \div 10,000) \times 100 = 200\%$$

- (ii) Contribution by 15,000 units = $15,000 \times (\text{Rs. } 8.75 - \text{Rs. } 7.00)$
 $= \text{Rs. } 26,250$

Budgeted contribution = $\text{Rs. } 25,000 + \text{Rs. } 5,000 = \text{Rs. } 30,000$

Additional contribution required = $\text{Rs. } 30,000 - \text{Rs. } 26,250$ or
 $\text{Rs. } 3,750$

Additional units required to produce contribution of $\text{Rs. } 3,750$
 $= \text{Rs. } 3,750 \div (\text{Rs. } 8.75 - \text{Rs. } 8.00) = 5,000 \text{ units.}$

Required increase in sale = $20,000 \text{ units} - 10,000 \text{ units}$
 $= 10,000 \text{ units}$

\therefore Percentage increase required = $(10,000 \div 10,000) \times 100 = 100\%$

- (iii) Contribution required = Fixed cost + Profit + Additional Publicity expenses = $\text{Rs. } 25,000 + \text{Rs. } 5,000 + 2,000 = \text{Rs. } 32,000$

Contribution by 15,000 units = $15,000 \times (\text{Rs. } 9.00 - \text{Rs. } 7.00)$
 $\text{Rs. } 30,000$

\therefore Additional contribution required = $\text{Rs. } 32,000 - \text{Rs. } 30,000$
 $= \text{Rs. } 2,000$

\therefore Additional units required to earn contribution of $\text{Rs. } 2,000$
 $= \text{Rs. } 2,000 \div (\text{Rs. } 9.00 - \text{Rs. } 8.00) = 2,000 \text{ units}$

\therefore Required increase in sales (in units) = $17,000 - 10,000 = 7,000$
 units

\therefore % increase in sales = $(7,000 \text{ units} \div 10,000 \text{ units}) \times 100 = 70\%$

- (vi) New variable cost = $\text{Rs. } 7.00 - \text{Rs. } 2.00 = \text{Rs. } 5.00$

\therefore Contribution on 10,000 units :
 $= 10,000 \text{ units} \times (\text{Rs. } 9.00 - \text{Rs. } 5.00) = \text{Rs. } 40,000$

If budgeted plan is followed, contribution will be = $\text{Rs. } 25,000 + \text{Rs. } 5,000 = \text{Rs. } 30,000$

\therefore Maximum increase in fixed cost to justify the proposal
 $= \text{Rs. } 10,000, \text{ i.e., } \text{Rs. } 40,000 - \text{Rs. } 30,000$

Impact on profit due to reduction in unit price on Additional Sales

Problem 9'35. Accuracy Calculators Ltd. manufactures engineering calculators and the selling price was fixed at Rs. 400. The following are the cost particulars :

Direct material cost	Rs. 140
Direct labour cost	
Variable factory overhead	Rs. 40
Other variable cost	Rs. 20
Fixed overhead	Rs. 20
Commission	Rs 50,000 per annum 30 % on selling price

The company was producing only 10,000 units. However, the company has the capacity to produce another 1,000 units without any additional fixed overhead. One of the distributors offered that they will take 1,000 units in addition to their normal quota, but at a selling price of Rs. 320 per unit. He was also prepared to accept only half of his regular commission for this transaction.

The managing director wants you as the Secretary of the company to prepare a statement to the board of directors with your specific recommendations based on calculation in the statement.

(C.S. Inter, June 1987)

Solution : **Statement of Profitability**

	<i>Current production</i>	<i>Additional production</i>	<i>Total</i>
	10,000 units	1,000 units	11,000 units
Selling price per unit	Rs. 400	Rs. 320	—
Sales	Rs. 40,00,000	3,20,000	Rs. 43,20,000
Direct materials cost	14,00,000	1,40,000	15,40,000
Direct labour	4,00,000	40,000	4,40,000
Variable fixed overhead	2,00,000	20,000	2,20,000
Other variable cost	2,00,000	20,000	2,20,000
Commission	12,00,000	48,000	12,48,000
Marginal cost	34,00,000	2,68,000	36,68,000
Contribution	6,00,000	52,000	6,52,000
Fixed cost	5,00,000	—	5,00,000
Profits	1,00,000	—	1,52,000

Comments. The acceptance of proposal will have the effect of increasing profits by Rs. 52,000 since no increase in fixed cost is involved. It should be accepted provided this does not produce depressing trend in prices in existing market.

B.F. Sales with increase in different Cost/Price components

Problem 9.36. The following is the budget of XYZ Ltd.

	<i>Fixed</i>	<i>Variable</i>	<i>Total</i>
	Rs.	Rs.	Rs.
Budgeted sales :			
2,00,000 units			
at Rs. 25 per unit			50,00,000

Budgeted costs :

Direct material		9,00,000	
Direct labour		10,00,000	
Factory overhead	7,00,000	3,00,000	
Administration overhead	6,00,000	1,00,000	
Distribution overhead	5,00,000	3,00,000	
Total	18,00,000	26,00,000	44,00,000
Budgeted profit			6,00,000

Compute the break-even point in the following independent situations if—

- (i) a 10% increase is effected in fixed costs.
- (ii) a 10% increase is effected in variable costs.
- (iii) a 10% increase is effected in sales price which will result in reduction in units sold by 5%.
- (iv) a 10% increase in fixed costs and 5% decrease in variable costs is effected.
(C.S. Final, Dec. 1986)

Solution : Budgeted sales units and selling price per unit is given. Variable cost per unit can be computed by total variable cost with budgeted volume. Then break-even point (value as well as volume) can be found out as follows :

<i>Particulars</i>	<i>Different situations</i>			
	(i) 10% increase in fixed costs	(ii) 10% increase in variables costs	(iii) 10% increase in S.P. and 5% reduction in sales volume	(iv) 10% increase in F.C. and 5% decrease in V.C.
1. S.P.	Rs. 25'00	Rs. 25'00	Rs. 27'50	Rs. 25'00
2. Variable cost	13'00	14'30	13'00	12'35
3. Contribution per unit	12'00	10'70	14'50	12'65
4. Fixed cost	19,80,000	18,00,000	18,00,000	19,80,000
5. BES (units) $4 \div 3$	1,65,000	1,68,224	1,24,138	1,56,522
6. BES (value) $5 \cdot 1$	41,25,000	42,05,600	34,13,795	39,13,050

$$\begin{aligned}\text{Variable cost per unit} &= (\text{Rs. } 9,00,000 + 10,00,000 + 3,00,000 \\ &\quad + \text{Rs. } 1,00,000 + \text{Rs. } 3,00,000) \div 2,00,000 \\ &= \text{Rs. } 13 \text{ per unit.}\end{aligned}$$

Profitability due to increase in Sales/Costs

Problem 9'37. Zed Ltd. reported the following figures for 1983 and 1984 :

	1983	1984
Sales	Rs. 50,00,000	Rs. 60,00,000
Total Cost	45,00,000	52,00,000

The Company anticipated that in 1985 :

- (i) Variable cost rates, on the average, would record an increase of 10 per cent over the 1984 levels ;
 - (ii) Sales would record an increase of 20 per cent over the 1984 level in volume.
 - (iii) Selling prices on the average would be increased by 5 per cent.
 - (iv) In addition, another Rs. 10 lacs of sale (1984 level) would be made to Government at a special discount of 10 per cent thereof ; and
 - (v) Fixed cost would increase by Rs. 3,00,000.
- (a) Ascertain the expected profit/loss in 1985 ;
- (b) If the increase in fixed costs mentioned above arises only if the sales to Government is made, would you recommend the sale to be made ?
- (c) What is the P/V ratio for 1985, normal sales ? Give workings.
(C S Final, June 1985)

Solution :

	Sales	Profit
1984	Rs. 60,00,000	Rs. 8,00,000
1983	50,00,000	5,00,000
Difference	10,00,000	3,00,000

$$\text{P/V ratio} = \frac{\text{Change in profit}}{\text{Change in sales}} = \frac{3,00,000}{10,00,000} \text{ or } 30\%$$

Sales during 1984 = Rs. 60,00,000

Variable cost (30% P/V ratio means 70% V.C.) = Rs. 42,00,000

$$S - V = F + P$$

$$\begin{aligned}\text{Fixed cost for 1984} &= \text{Rs. } 60,00,000 - 42,00,000 - 8,00,000 \\ &= \text{Rs. } 10,00,000\end{aligned}$$

(a) Expected profit/loss in 1985

Sales for 1984	Rs. 60,00,000
Add : 20% increase in volume	12,00,000
	<hr/> 72,00,000
Add : 5% increase in selling price	3,60,000
	<hr/> 75,60,000
Add : Sales to Govt. (Rs. 10 lacs less 10% discount)	9,00,000
	<hr/> 84,60,000
Total sales for 1985	

Variable Costs

Sales at 1984 level	Rs. 60,00,000
Volume increase (20%)	12,00,000
Sales to Government	10,00,000
	<hr/> 82,00,000 *
Less : Variable cost (77% of Rs. 82,00,000)	63,14,000
Contribution	<hr/> 21,46,000
Less : Fixed costs (Rs. 10,00,000 + Rs. 3,00,000)	13,00,000
	<hr/> 8,46,000
Net profit during 1985	
(b) Sales to Government (after discount)	Rs. 9,00,000
Less : Variable cost (77% of 10,00,000)	7,70,000
	<hr/> 1,30,000
Contribution	
Increase in fixed cost	3,00,000
	<hr/> 1,70,000
Net loss	

Hence, sale to Government is not recommended

(c) Normal sales (without sales to Government)	Rs. 75,60,000
Variable cost 77% of (Rs. 82,00,000 - 10,00,000)	55,44,000
	<hr/> 20,16,000
Contribution	

P/V ratio = $20,16,000 \div 75,60,000 \times 100$ or 26.67%

*Variable cost is related to sales volume. Price increase will not affect the variable cost.

Profitability after special reduced prices

Problem 438. Jigsaw Teasers are in the business of marketing jigsaw puzzles. The general procedure is to acquire production rights from art collectors and museums, get an external processor to produce the whole print on suitable cardboard and sell the finished product at Rs. 25 per unit through retail outlets, after precision dye cutting into

component parts which constitute the jigsaw. The minimum print order is 6,200, with costs going down as follows :

Order size (number)	6,250	15,000	25,000	50,000
	(Cost per unit (Rs.))			
Materials, printing and cutting (payable to external processors)	29.20	15.36	13.25	11.04
Overheads (based on expected sales volume of 2 lacs units, and fixed overheads of Rs. 14 lacs per annum)	7.00	7.00	7.00	7.00
Total unit cost	36.20	22.36	20.25	18.04

In the first eight months, the company sold 1.5 lacs units and made a profit of Rs. 19.35 lacs, after recovering Rs. 10 lacs towards overheads. In the remaining four months of the year, a further Rs. 4 lacs of overheads must be recovered and any possible profit made.

At this point of time, the company is obliged to take on several prints which are unlikely to be popular and therefore call for special sales promotions and price reduction schemes. The following data is made available.

A sale of 0.2 lac units at normal selling price of Rs. 25 per unit (variable cost Rs. 11.04/unit) is estimated. Further sales will depend upon special prices as follows :

(Variable costs per unit : Rs. 15.36 in all cases)

At Rs. 20/unit	0.15 lac units
At Rs. 18/unit	0.20 lac units
At Rs. 15/unit	0.35 lac units

On the basis that the Company does not wish to make a loss in the next four months, you are to advise the management on the desirability or otherwise of operating the proposed special prices of Rs. 20, Rs. 18 or Rs. 15 per unit on the less popular puzzles. Also, indicate what, if any, further reductions could be accepted if the market does not respond to the lower prices proposed. Ignore interest on working capital

(C.S. Final, June 1984)

Solution : Statement showing the Comparative Profitability

Particulars	Sale at normal Price (unit sold 1,50,000)	Further sale at special prices			
Selling price per unit	Rs. 25.00	Rs. 20.00	Rs. 18.00	Rs. 15.00	
Variable cost	11.04	15.36	15.36	15.36	
Contribution per unit	13.96	4.64	2.64	(-)0.36	
Ranking	I	II	III	Loss	

Profitability during remaining 4 months

Expected annual sales volume		2,00,000 units
Less : Sales volume during 8 months		1,50,000
Sales volume during 4 months		<u>50,000 units</u>
<i>Ranking Units expected to be sold</i>	<i>Contribution per unit</i>	<i>Total contribution</i>
I 20,000 (Given)	Rs. 13.96	Rs. 2,79,200
II 15,000 (Given)	4.64	69,600
III 15,000 (Balance)	2.64	39,600
<u>50,000</u> Total contribution		<u>3,88,400</u>
Less : Fixed cost for 4 months		4,00,000
Loss		<u>11,600</u>

The company will not be able to earn any profit during next 4 months. Therefore, the company should find out the way to reduce the overheads.

Comparative profitability of different proposals

Problem 9-39. The anticipated sales of Electronic Corporation Ltd. is Rs. 4,00,000 and unit cost of a product is Rs. 20 each. The cost of direct material is Rs. 9 each and the labour cost is Rs. 3 each and other variable expenses are Rs. 3 per unit. The company is earning a net profit of 5% and to improve the profitability following proposals were discussed in the Executive Committee Meeting :

- The present administrative setup is on the regional basis, and it was felt that centralisation will reduce the fixed cost by Rs. 12,000
- The Production Manager has agreed that he will try to work on a cost reduction programme which will reduce the cost by Re. 1 per unit but there will be little impact on the quality which will be negligible to the customer.

The Sales Manager opposed the two proposals and suggests that it may be possible to increase the number of units sold by 20% provided the selling price is reduced by 5%. Alternatively, if the selling price is increased by 10%, the sales number of units will be reduced by 5%.

As the Secretary of the Company, discuss in detail the various pros and cons of the proposals, and also put forward any other proposal to improve the situation.

(C.S. Final, December 1983)

Solution :

	<i>Per unit</i> Rs.	<i>Total</i> Rs.
Sales (20,000 units)	20	4,00,000
Variable Costs —Direct materials	9	1,80,000
—Labour	3	60,000
—Other variable expenses	3	60,000
Total variable cost	15	3,00,000
Contribution	5	1,00,000
Less : Profit 5% of 4,00,000		20,000
Total fixed cost		80,000

Statement showing the Profitability of Four Proposals

<i>Proposal</i>	<i>1</i> <i>Central ad- ministration (Reduction in F.C. by Rs. 12,000)</i>	<i>2</i> <i>Variable cost reduc- ed by Re. 1 price unit</i>	<i>3</i> <i>20% in- crease in sales units with 5% reduction in selling price</i>	<i>4</i> <i>10% in- crease in selling price and 5% reduc- tion in sales units</i>
Sales (units)	20,000	20,000	24,000	19,000
Selling price per unit	Rs. 20	Rs. 20	Rs. 19	Rs. 22
Variable cost	15	14	15	15
Contribution per unit	5	6	4	7
Total contribution (Sales units × Contribution p. unit)	1,00,000	1,20,000	96,000	1,33,000
Less : Fixed cost	68,000	80,000	80,000	80,000
Net profit	32,000	40,000	16,000	53,000
Anticipated profit	20,000	20,000	20,000	20,000
Increase (Decrease) in profit	(+)12,000	(+)20,000	(-)4,000	(+)33,000

The proposal of Sales Manager for 20% increase in sales units with 5% reduction in selling price is not at all acceptable as this will result in loss of Rs. 4,000. The Production Manager anticipated reduction in variable cost by Re. 1 per unit but there will be a little impact in quality. This proposal is fraught with marketing dangers. The lower

quality of the product will have long-range disadvantages as compared to the product of the competitors. The Sales Manager's second proposal is really attractive as it will fetch additional profit worth Rs. 33,000. The first proposal will yield additional profit of Rs. 12,000. As a company secretary, I recommend combination of proposals 1 and 4.

Quotation for an order—unutilized capacity

Problem 9'40. A manufacturer of fountain pens selling in the market at Rs. 100 per dozen makes an average net profit of 20% on sales by producing 50,000 dozen per annum against a capacity of 75,000 dozens. His cost sheet for 1984 was as under :

	<i>Cost per dozen (Rs.)</i>
Direct materials	36
Direct wages	30
Works overheads (50% of this is variable)	10
Sales overhead (25% of this is variable)	4

In 1985, he anticipates his fixed costs to increase by 6%, cost of direct materials by 5% and labour (with whom an agreement had been concluded) by 10%. Market enquiries revealed that the selling price of the product and quantity will remain unchanged in 1985.

An inquiry has been received for the supply of 10,000 dozens to a customer. What could be the lowest quotation, if the business wants to make a minimum profit of Rs. 8 lacs in 1985 ? Give detailed workings.

(b) Gee Ltd., has two factories producing an identical product and realising the same selling price net, i.e., Rs. 60 per unit. The costs in the two factories can be summarised as follows :

	<i>Factory A</i>	<i>Factory B</i>
Capacity (units)	1,00,000	1,50,000
Variable cost per unit (Rs.)	20	15
Fixed cost per annum (Rs.)	20,00,000	45,00,000

The demand for the product is 2,00,000 units in all. State how much should be produced at each factory. (C.S. Final, December 1984)

Solution : (a) **Profitability during 1984 (50,000 dozen)**

	<i>Per dozen</i>	<i>Total</i>
Sales	Rs. 100	Rs. 50,00,000
Variable cost	72	36,00,000
Contribution	28	14,00,000
Less : Fixed cost	8	4,00,000
Profit (20% of sales)	20	10,00,000

Profitability during 1985 (50,000 dozens)

Sales	Rs. 100	Rs. 50,00,000
Variable Costs :		
Raw materials (Rs. 35 × 1'05)	37'80	18,90,000
Direct wages (Rs. 30 × 1'10)	33'00	16,50,000
Variable works overheads	5'00	2,50,000
Variable sales overheads	1'00	50,000
	<u>76'80</u>	<u>38,40,000</u>
Contribution	23'20	11,60,000
Less : Fixed overheads :		
Works overhead (Rs. 5 × 1'06)	5'30	
Sales overheads (Rs. 3 × 1'06)	3'18	
	<u>8'48</u>	<u>4,24,000</u>
Profit (Contribution — F.C.)	14'72	7,36,000
Desired profit in 1985		Rs. 8,00,000
Profit already earned		<u>7,36,000</u>
Additional profit desired (for 10,000 dozens)		<u>64,000</u>
Additional profit per dozen		Rs. 6'40
Variable cost as above		<u>76'80</u>
Lowest quotation per dozen		<u>83'20</u>

	Factory A	Factory B
(b) Production (units)	50,000*	1,50,000
Selling price per unit	Rs. 60	Rs. 60
Variable costs	20	15
Contribution	40	45
Total contribution	20,00,000	67,50,000
Less : Fixed Cost	20,00,000	45,00,000
Total profit	Nil	22,50,000

*Total demand 2,00,000 units. As the contribution is higher in Factory B, it should be produced to the maximum capacity. The

balance production of 50,000 units (2,00,000 – 1,50,000) should be undertaken in factory A.

Evaluation of alternative proposals due to increase in Sales Price/Costs

Problem 9-41 The management accountant of X Ltd., has prepared the following estimates of working results for the year ending 31st December, 1986 for the purpose of preparing the budgets for the year ending 31st December, 1987.

Year ending 31-12-1986		
Direct material	Rs./unit	16'00
Direct wages	"	40'00
Variable overheads	"	12'00
Selling price	"	125'00
Fixed expenses	Rs.	6,75,000 per annum
Sales	Rs.	25,00,000 per annum

During the year 1987, it is expected that the material prices and variable overheads will go up by 10% and 5% respectively. As a result of reorganisation of production methods the overall direct labour efficiency will increase by 12%, but the wage rate will go up by 5%. The fixed overheads are also expected to increase by Rs. 1,25,000.

The Technical Director states that the same level of output as obtained in 1986 should be maintained in 1987 also and efforts should be made to maintain the same level of profit by suitably increasing the selling price.

The Marketing Director states that the market will not absorb any increase in the selling price. On the other hand he proposes that publicity involving advertisement expenses in the proportions will increase the quantity of sales as under :

Advertisement expenses (Rs.)	80,000	1,94,000	3,20,000	4,60,000
Additional units of Sales	2,000	4,000	6,000	8,000

Required :

- Present an income statement for the year 1986.
- Find the revised price and the percentage of increase in the price for 1987 if the Technical Director's views are accepted.
- Evaluate the four alternative proposals put forth by the Marketing Director, determine the best output level to be budgeted and prepare an overall income statement for 1987 at that level of output.

(I.C.W.A. Final, Dec 1986)

Solution :

No. of units produced and sold $\text{Rs. } 25,00,000 \div 125 = 20,000$.

Variable Cost per unit

	1986 Rs./unit	1987	
Direct material	16'00	16×1.10	= 17'60
Direct wages	40'00	$40 \times (1 \div 1.12) \times 1.05$	= 37'50
Variable overhead	12'00	12×1.05	= 12'60
Total variable cost	68'00		67'70

(i) Income Statement for 1986

Sales	Rs. 25,00,000
Less : Variable cost (Rs. 20,000 \times Rs. 68)	13,60,000
Contribution	11,40,000
Less : Fixed cost	6,75,000
Profit	4,55,000
P/V ratio	45.6%

(ii) Revised selling price without change in output and level of profit

Revised variable cost

$$(20,000 \times 67.70) = \text{Rs. } 13,54,000$$

$$\text{Revised fixed cost} = \text{Rs. } 6,75,000 + 1,25,000 = 8,00,000$$

$$\begin{aligned} \text{Sales} &= \text{Fixed cost} + \text{Profit} + \text{Variable cost} \\ &= \text{Rs. } 8,00,000 + 4,65,000 + 13,54,000 \\ &= \text{Rs. } 26,19,000 \end{aligned}$$

$$\text{Selling price per unit} = 26,19,000 \div 20,000 = \text{Rs. } 130.95/\text{unit}$$

$$\text{Percentage increase} = \text{Rs. } 130.95 - 125 = 5.95$$

$$= \frac{5.95}{125} \times 100 = 4.76\%$$

(iii) Contribution

$$\text{per unit} = \text{Rs. } 125 - 67.70 = \text{Rs. } 57.30$$

Additional units of sales	2,000	4,000	6,000	8,000
Contribution from additional sales @ Rs. 57.30	Rs. 1,14,600	2,29,200	3,43,800	4,58,400
Advertisement expenses	80,000	1,94,000	3,20,000	4,60,000
Profit	34,600	35,200	23,800	(--) 1,600

The profit at additional 4,000 units is the maximum. So the revised output level will be 20,000 + 4,000 or 24,000 units.

Overall Income Statement for the Year 1987

Output		24,000 units
Sales (24,000 × 125)		Rs. 30,00,000
Variable Cost @ Rs. 67.70		16,24,800
Contribution		13,75,200
Less : Fixed cost	8,00,000	
Additional advertisement	1,94,000	94,000
Profit for 1987		3,81,200
P/V Ratio		45.84%

Revised Selling Price due to increase in various cost components

Problem 9.42. Reprographics Ltd., manufactures a documents reproducing machine which has a variable cost structure as follows :

Material	Rs. 40
Labour	10
Overhead	4
Selling price	90

Sales during the current year are expected to be Rs. 13,50,000 and fixed overhead Rs. 1,40,000.

Under a wage agreement an increase of 10% is payable to all direct workers from the beginning of the forthcoming year, while material costs are expected to increase by 7.5% ; variable overhead costs by 5% and fixed overhead costs 3%.

You are required to calculate :

(a) The new selling price if the current P/V ratio is to be maintained ; and

(b) the quantity to be sold during the forthcoming year to yield the same amount of profit as the current year assuming the selling price to remain at Rs. 90.

(C A. Inter, May 1985)

Solution : (a) **New Selling Price if the current P/V Ratio is to be maintained**

	Existing variable cost	% increase	Revised variable cost
Material	Rs. 40	7.5%	Rs. 43.00
Labour	10	10.0%	11.00
Variable overhead	4	5.0%	4.20
			58.20

Fixed cost	Rs. 1,40,000
Revised fixed cost with 3% increase	1,44,200

$$\text{Current year's P/V Ratio} = (\text{Sales} - \text{Variable cost}) / \text{Sales} \\ = (\text{Rs. } 90 - 54) \div 90 \text{ or } 40\%$$

or Current year's marginal cost = 60%

(∵ Marginal cost is reciprocal of P/V Ratio)

If the marginal cost is Rs. 60 then sales = Rs. 100

$$\text{If the marginal cost is Rs. } 58.20 \text{ then sales} = \frac{100}{60} \times 58.20$$

New selling price = Rs. 97

(b) Quantity to be sold to yield the same amount of profit as the current year

Existing profit

Current year's sales	= Rs. 13,50,000
Contribution (40% of Sales)	= Rs. 5,40,000
Less : Fixed cost	1,40,000
Profit	4,00,000

Contribution of the forthcoming year

Revised fixed cost	Rs. 1,44,200
Add : Profit	4,00,000
Total contribution	5,44,200

Contribution per unit = Rs. 90 - Rs. 58.20 = Rs. 31.80

$$\text{Sales Qty. required} = \text{Total contribution} \div \text{Contribution per unit} \\ = \text{Rs. } 5,44,200 \div \text{Rs. } 31.80 \\ = 17,113 \text{ machines}$$

Profitability due to increase/decrease in price/costs and volume

Problem 9 43. The XYZ Co. has the following budget for the year 1986-87 :

Sales (1,00,000 units @ Rs. 20)	Rs. 20,00,000
Variable cost	10,00,000
Contribution	10,00,000
Fixed cost	4,00,000
Net profit	6,00,000

From the above set of information find out :

(a) The adjusted profits for 1985-87 if the following two sets of changes are introduced and also suggest which plan should be implemented.

<i>Plan A</i>		<i>Plan B</i>	
Increase in price	20%	Decrease in price	20%
Decrease in volume	25%	Increase in volume	25%
Increase in variable cost	10%	Decrease in variable cost	10%
Increase in fixed cost	5%	Decrease in fixed cost	5%

(b) The P/V ratio and break-even points under the two plans referred above.

(I.C.W.A. Inter, June 1986)

Solution.

XYZ & CO.

Budget 1985-87

Units 1,00,000

	<i>Per unit</i>	<i>Total</i>
Sales	Rs 20	Rs 20,00,000
Variable	10	10,00,000
Contribution	10	10,00,000
Fixed cost	4	4,00,000
Profit	6	6,00,000

(a)	<i>Plan 'A'</i>	<i>Plan 'B'</i>
Units		
[1,00,000 - 1,00,000 × 25%]	75,000	
[1,00,000 + 1,00,000 × 25%]		1,25,000
Selling price per unit		
[Rs. 20 × 1.20]	24	
[Rs. 20 × 0.80]		16
Variable cost per unit		
[Rs. 10 × 1.10]	11	
[Rs. 10 × 0.90]		9
Contribution per unit	13	7
Total contribution	9,75,000	8,75,000
Fixed cost		
[4,00,000 × 1.05]	4,20,000	
[4,00,000 × 0.95]		3,80,000
Profit	5,55,000	4,95,000

It can be clearly seen from the above working that estimated profit is highest in the original budget. Therefore, neither Plan A nor Plan B should be implemented and followed.

(b)	Budget	Plan A	Plan B
Contribution (Rs.)	10,00,000	9,75,000	8,75,000
Sales	20,00,000	18,00,000	20,00,000
Fixed cost	4,00,000	4,20,000	3,80,000
P/V ratio	50%	54.17%	43.75%
BEP (Fixed cost/ P/V Ratio)	Rs. 8,00,000	7,75,385	8,68,571
BEP (units) (By dividing of sales by selling price per unit)	40,000	32,308	54,286

Increase in Sales Volume of a Product to Wipe out Overall Loss

Problem 9-44. The Budgeted results of 'X' Ltd. is set out below in respect of the various products processed at the Plant.

Product	Sales in Rs. Lakhs	Variable Cost as % of Sales Value
A	5	60%
B	4	50%
C	8	65%
D	3	80%
E	6	75%
Total	26	65.77%

Fixed Costs for the period are estimated at Rs. 9 lakhs. Required :

(a) A statement showing the loss that would result.

(b) Recommend a change in sales volume of each product which will eliminate the expected losses on the basic assumption that the sales of only one product can be increased at a time.

(I.C.W.A. Final, December, 1984 R.S.)

Solution : Statement showing the Profitability of the Existing Product-Mix

Product	Sales	Variable cost	Contribution (S-V)	P/V ratio (S-V)/S	Ranking
A	5.00	3.00	2.00	40%	II
B	4.00	2.00	2.00	50%	I
C	8.00	5.20	2.80	35%	III

<i>D</i>	3'00	2'40	0'60	20%	<i>V</i>
<i>E</i>	6'00	4'50	1'50	25%	<i>IV</i>
Total	<u>26'00</u>	<u>17'10</u>	<u>8'90</u>		
Less : Fixed cost			<u>9'00</u>		
Loss			<u>0'10</u>		

As product *B* has the highest P/V ratio. First of all its sales should be increased followed by other products to wipe out the loss of Rs. 10,000 :

<i>B</i> Loss ÷ P/V ratio	= Rs. 10,000 ÷ 50% = Rs. 20,000
or <i>A</i>	= Rs. 10,000 ÷ 40% = Rs. 25,000
or <i>C</i>	= Rs. 10,000 ÷ 35% = Rs. 28,571
or <i>E</i>	= Rs. 10,000 ÷ 25% = Rs. 40,000
or <i>D</i>	= Rs. 10,000 ÷ 20% = Rs. 50,000

Note : It is given that sales of only one product can be increased at a time. In the above case if sales of Product *B* is increased by Rs. 20,000, the sale of other products will remain unchanged. Therefore, it is a case of mutually exclusive proposals. Increase in sale of either of the five products will not effect the sales of other products. Increase in sales of either of these products will be according to the ranking.

Profitability due to Discontinuance of a Product or Reduce its Price

Problem 9-45. The following is the summarized Trading Account of a manufacturing concern which makes two Products, *X* and *Y*

Summarized Trading Account for the four months to 30th April, 1984 :

	<i>X</i>	<i>Y</i>	<i>Total</i>
Sales	Rs. 10,000	Rs. 4,000	Rs. 14,000
Less : Cost of sales			
*Direct costs			
Labour	3,000	1,000	
Materials	1,500	1,000	2,000
	<u>5,500</u>	<u>2,000</u>	<u>7,500</u>
Indirect costs			
*Variable expenses	2,000	1,000	3,000
	<u>3,500</u>	<u>1,000</u>	<u>4,500</u>

† Fixed expenses

Common to both X and Y	1,250	1,250	2,500
Net profit	Rs. 2,250	(-) Rs. 250	Rs. 2,000

* These costs tend to vary in direct proportion to physical output.

† These costs tend to remain constant irrespective of the physical outputs of X and Y. It has been the practice of the concern to allocate these costs equally between X and Y.

The following proposals, have been made by the Board of Directors for your consideration as a financial adviser :

- (1) Discontinue product Y.
- (2) As an alternative to (1), reduce the price of Y by 20 per cent. (It is estimated that the demand will then increase by 40 per cent).
- (3) Double the price of X. (It is estimated that this will reduce the demand by three-fifth.)

You are required to recommend the proposal to be taken after evaluating each of these three proposals (C.A. Final, May, 1984)

Solution : (1) **Discontinue Product Y**

Existing contribution from Product X	= Rs. 3,500
Less : Fixed expenses (including those of Y)	2,500
Net profit	1,000

In this case, the net profit of the company has come down by 50%.

- (2) **Reduce the Price of Y by 20% with Corresponding Volume Increase by 40%**

Sale of Product Y	= Rs. 4,000
Less : Price reduction by 20%	800
	3,200
Add : 40% volume increase	1,200

Revised sales value of Product Y	4,400
Less Variable costs :	
Labour and materials	2,000
Indirect costs (variable)	1,000
	3,000
Add : Volume adjustment 40%	1,200
	4,200

Contribution	280
Less : Fixed expenses	1,250
	<hr/>
Loss on Product Y	(970)
Add : Existing profit on product X	2,250
	<hr/>
Revised profit for the company	1,280
	<hr/>

By implementing this proposal, the profit has decreased by 36%.

(3) Double the Price of X with Corresponding Reduction in Volume by Three-Fifth

Existing sales of X	Rs. 10,000
Increase 100%	10,000
	<hr/>
Revised sales	20,000
Less : Reduction in volume (60%)	12,000
	<hr/>
Revised sales of product X	8,000
Less : Variable costs :	
Labour and material	4,500
Indirect costs (variable)	2,000
	<hr/>
	6,500
Less : Adjustment for volume decrease by 60%	3,300
	<hr/>
	2,600
	<hr/>
Contribution	5,400
Less : Fixed costs	1,250
	<hr/>
Net profit of product X	4,150
Loss on product Y	(250)
	<hr/>
Net profit to the company	3,900
	<hr/>

There is an increase in company's profit by 95%. Hence proposal (3) should be accepted.

PRODUCT MIX

Determination of Suitable Product Mix, Constraint being Machine Capacity

Problem 9.46. LMN Ltd. are considering adding to their product line products X, Y and Z, on grounds of their present technical abilities, knowledge of markets and productive flexibility. It is however, considered necessary to add to the existing plant to cater for this added production.

The following estimates regarding cost, revenue, demand and production time are made in respect of the new products :

	Prod. X	Prod. Y	Prod. Z
Average variable costs per unit (Material, labour, variable overhead)	Rs. 200	Rs. 320	Rs. 280
Selling price/unit	350	420	370
Demand in units for cost period (on the basis of above selling price)	200	125	75
Machine-hours required per unit of production	15	5	3

Calculate within the demand constraint in each cost period assuming that additional 4,000 machine hours of production capacity can be established, the quantity of each new product which should be manufactured to contribute highest margin towards fixed overhead and profit.

(ICWA Int. Examination, 1985)

Solution :

Products	Per unit contribution		
	X	Y	Z
Selling price/unit	Rs. 350	Rs. 420	Rs. 370
Average variable costs	200	320	280
Contribution per unit	150	100	90
Machine hours per unit	15	5	3
Contribution per machine hour	10	20	30
Ranking (Machine hour constraint)	III	II	I

Statement showing the Contribution Based on Projected Product-Mix Considering 4,000 Machine Hours as Constraint

Product	Units	Machine hours/unit	Total machine hours	Unit contribution	Total contribution (1) × (4)
	(1)	(2)	(3)	(4)	(5)
Z	75	3	2,250	Rs. 90	Rs. 67,500
			625	100	12,500
Y	75*	15	1,125 (balance)	150	11,250
			4,000		91,250

Considering the constraint of machine hours, the contribution of Rs. 91,250 is the highest to meet fixed overheads and profit.

* $1,125 \div 15 = 75$.

Production Programme and Profitability with Two Constraints

Problem 9'47. X Ltd. produces two products and following particulars are detailed for these two products :

	<i>Product A</i>	<i>Product B</i>
Sales price per unit	Rs. 6'00	Rs. 3'75
Direct material cost per unit	Rs. 3'00	Rs. 2'00
Direct labour hours per unit	1 hour	1/2 hour
Standard hourly rates : Direct labour	Rs. 2'00	Rs. 2'00
Variable overhead per unit	Rs. 0'50	Rs. 0'50
Fixed overheads budgeted	Rs. 50,000	
Total direct labour hours available	1,00,000	

The Company does not want to reduce the production of Product A below 30,000 units and Product B below 1,00,000 units. Assume that materials are freely available and that materials and available direct labour can be freely used for either of products, subject to the minimum production as stipulated above.

Suggest the best Production Programme by outlining the steps along with the statements for the purpose and show the Net Profit expected from this programme.
(I.C.W.A. Inter, December, 1985)

Solution : First of all, contribution per unit for both the products should be found out :

	<i>Product A</i>	<i>Product B</i>
Selling price per unit	Rs. 6'00	Rs. 3'75
Less : Variable costs :		
Direct material	3'00	2'00
Direct labour	2'00	1'00
Variable overhead	0'50	0'50
	5'50	3'50
Contribution	0'50	0'25
Contribution per direct labour hours	0'50	0'50

It is given that production of Product A cannot be reduced below 30,000 units and Product B below 1,00,000 units with 1,00,000 total direct labour hours. So with these constraints, the alternative production programmes are as under :

<i>Product</i>	<i>Units</i>	<i>Direct labour hours</i>	<i>Contribution per unit</i>	<i>Total contribution</i>
<i>A</i>	30,000	30,000	Re. 0'50	Rs. 15,000
<i>B</i>	1,00,000	50,000	0'25	25,000
<i>B</i>	40,000	20,000 (balance)	0'25	10,000
Total		1,00,000		50,000

Fixed overheads	50,000
Net profit	Nil

OR

B	1,00,000	50,000	0.25	25,000
A	30,000	30,000	0.50	15,000
A	20,000	20,000 (balance)	0.50	10,000
Total		1,00,000		50,000

Fixed overheads	50,000
Net profit	Nil

The contribution and net profit expected in both the alternatives is the same. X Ltd.'s net profit is nil. Therefore, efforts should be made to reduce the variable costs

Best Possible Production Mix : Constraint being Machining Process

Problem 9'48. Mega Corporation manufactures and sells three products to the automobile industry. All the products must pass through a machining process, the capacity of which is limited to 20,000 hours per annum, both by equipment design and government regulation.

The following additional information is available :

	Product X	Product Y	Product Z
Selling price Rs./unit	19,000	2,400	4,000
Variable cost Rs./unit	700	1,200	2,800
Machine requirement hrs./unit	3	2	1
Maximum possible sales units	10,000	2,000	1,000

Required : A statement showing the best possible production mix which would provide the maximum profits for Mega Corporation, together with supporting workings.
(CS. Final, June 1984)

Statement showing the best production mix (Capacity constraint 20,000 machine hours)

Particulars	Products		
	X	Y	Z
Contribution per unit	Rs. 1,200	Rs. 1,200	Rs. 1,200

2. Machine hours per unit	3	2	1
3. Contribution per machine hour ($1 \div 2$)	Rs. 400	Rs. 600	Rs. 1,200
4. Ranking	III	II	I
5. Total sales units	10,000	2,000	1,000
6. Machine hours required (5×2) but limited to balance 20,000 machine hours	*15,000 balance	4,000	1,000
7. Total contribution (6×3)	60,00,000	24,00,000	12,00,000
Total contribution	Rs 96,00,000		
*Total Machine Hours		20,000	
Less for Products Z & Y		5,000	
		15,000	

Effect on Budgeted Income due to Shift in the Product-mix

Problem 9:49. The budgeted income statement by product lines of Multiproducts Ltd. for 1985 is as follows :

	Product A	Product B	Product C
	Rs. 2,00,000	Rs. 5,00,000	Rs. 3,00,000
Sales			
Variable Expenses :			
Cost of goods sold	90,000	2,70,000	1,50,000
Selling	30,000	90,000	45,000
Fixed Expenses :			
Overhead	36,000	90,000	54,000
Administrative	16,000	40,000	24,000
Income before Tax	28,000	10,000	27,000
Income Tax @ 40%	11,200	4,000	10,800
Net Income	16,800	6,000	16,200

All products are manufactured in the same facilities under common administrative control. Fixed expenses are allocated among the products in proportion to their budgeted sales volume :

- Compute the budgeted break-even point of the company as a whole, from the data provided.
- What would be the effect on Budgeted Income if half of the budgeted sales volume of Product B were shifted to Product A and C in equal rupee amounts, so that the total Budgeted Sales in rupee remain the same.
- What would be effect of the shift in the product mix suggested in (b) above on the budgeted break-even point of the whole company ?

(C.A. Inter, N.S., Nov., 1984)

**Solution : Budgeted Income Statement of Multiproducts Ltd.,
for the year 1985**

	Product A	Product B	Product C	Total
1. Sales	Rs. 2,00,000	Rs. 5,00,000	Rs. 3,00,000	Rs. 10,00,000
2. Total Variable expenses	1,20,000	3,60,000	1,95,000	6,75,000
3. Contribution (1-2)	80,000	1,40,000	1,05,000	3,25,000
4. Total fixed cost	52,000	1,30,000	78,000	2,60,000
5. Income before tax	28,000	10,000	27,000	65,000
6. Less : Income tax @ 40%	11,200	4,000	10,800	26,000
Net Income	16,800	6,000	16,200	39,000

(a) Budgeted Break-even point for the whole company

$$\begin{aligned} \text{P/V ratio} &= (\text{Contribution} \div \text{Sales}) \times 100 \\ &= (\text{Rs. } 3,25,000 \div 10,00,000) \times 100 \quad \text{or } 32.5\% \end{aligned}$$

Break-even Point \times P/V ratio = Fixed cost

$$\text{BEP} = \text{Rs. } 2,60,000 \div 32.5 \times 100 \quad \text{or Rs. } 8,00,000$$

(b) Effect on budgeted income when half of the budgeted sales volume of Product B were shifted to Product A and C

	Product A	Product B	Product C	Total
1. Sales	3,25,000	2,50,000	4,25,000	10,00,000
2. Total variable expenses	1,95,000	1,80,000	2,76,250	6,51,250
3. Contribution	1,30,000	70,000	1,48,750	3,48,750
4. Fixed cost				2,60,000
5. Profit before tax				88,750
6. Income tax				35,500
7. Profit after tax				53,250

(c) New Break even point

$$\text{P/V ratio} = \frac{\text{Contribution}}{\text{Sales}} = \frac{\text{Rs. } 3,48,750}{1,00,000}$$

BES \times P/V ratio = Fixed cost

$$\text{BES} \times \frac{3,48,750}{10,00,000} = 2,60,000$$

BES = Rs. 7,45,520 Approx.

New product mix has brought down the break-even point by Rs. 54,480 i.e., Rs. 8,00,000—Rs. 7,45,520.

Note. Revised variable cost should be calculated based on variable cost and sales ratio existing before revision of sales mix for each product.

Productwise Contribution and Net Income with and without Overtime.

***Problem 9.50.** Allplay Ltd. are specialists in the manufacture of dolls for children. They manufacture and market four types of dolls patented under the names, Dolly, Molly, Jolly, Polly and a doll dress sewing kit. They require your assistance as a Cost Accountant for determining the appropriate sales and product-mix of their products for the coming year. From the production standards established, market forecasts and pricing policies, you get the following data :

Doll's name	Estimated demand for next year	Standard material cost per unit	Standard labour cost per unit	Estimated net price per unit
	Unit	Rs.	Rs.	Rs.
Dolly	50,000	1.40	0.80	8.20
Molly	42,000	0.76	0.50	2.40
Jolly	35,000	2.70	1.40	8.50
Polly	40,000	1.00	1.00	4.00
Sewing kit	3,25,000	0.60	0.40	3.00

(i) To promote sales of the sewing kit, there is a 15% discount offered in the established price of a kit, purchased at the same time along with a doll and it is expected that all the customers will avail this benefit.

(ii) The labour rate of Rs. 2.00 per hour is expected to continue without change in the next year. The plant has an effective capacity of 1,30,000 labour hours on a single shift basis. Present equipment can produce all of the products. Overtime worked is paid at double the normal rate.

(iii) Next year's fixed cost is estimated at Rs. 30,000 in the factory, Rs. 20,000 in administration and Rs. 50,250 in selling and distribution.

(iv) Variable costs will be equivalent to 50% of Standard Direct Labour Cost.

(v) The company has a very small inventory of its products that can be ignored.

(a) You are required to draw a conservative estimate for the next year of the total contribution that would be made by each product line and the net income that would be earned by the company.

(b) The company is at present having some industrial relations problem and if this continues in the next year, it would not then be possible to arrange for overtime work. Anticipating that eventuality, you are required to suggest a product-mix that would absolutely minimize the drop in the income already envisaged.

With that product-mix, work out product-wise contribution and the new net income that would be earned as a result.

(I.C.W.A. Final, December, 1982)

Suggested Approach

Attempt should be made on following lines :

(i) Determine number of sewing kits to be sold at reduced rate and at normal rate.

(ii) Labour hours required for producing the given mix. If company works for more than 1,30,000 hours, O.T. will have to be paid.

(iii) Statement showing profit, when O.T. can be worked.

(iv) Statement showing profit, when time is the key factor and O.T. cannot be worked.

Solution. *Number of sewing kits to be sold at reduced price*

It should be noted that the company would offer a discount of 15% on the established price of a sewing kit provided the same is purchased along with a doll. The established net price per unit of sewing kit is Rs. 3 and if the same is purchased along with the doll, its price would be reduced to Rs. 2.55 per kit. Now it is necessary to know the number of kits sold at Rs. 2.55 and at Rs. 3.00 each

Estimated demand for the next year for sewing kit	Nos. 3,25,000
Estimated demand for the next year for the dolls (all varieties) for which one sewing kit is also required	1,67,000*
No. of sewing kits sold without dolls	<u>1,58,000</u>

*Total number of dolls sold

Because all customers who are expected to purchase dolls, will also purchase the sewing kit, the price of a kit will be Rs. 2.55 for 1,67,000 numbers. The remaining kits (i.e., 1,58,000) will be sold at usual price of Rs. 3 for each kit.

Labour hours required for producing all products

The factory is predominantly labour intensive as its capacity is expressed in terms of labour hours. It is necessary to find out the requirement of total labour hours considering estimated demand, standard labour cost per unit and the labour rate per hour. The requirement of total labour hours would be as under :

Doll's name	No. of units	Standard labour cost per unit	Standard labour rate per hour	Total hrs.	No. of units
				Std. lab. cost per unit Std. lab. rate per hour	
		Rs.	Rs.	Hours	
Dolly	50,000	0.80	2.00	20,000	
Molly	42,000	0.50	2.00	10,500	
Jolly	35,000	1.40	2.00	24,500	
Polly	40,000	1.00	2.00	20,000	
Sewing kit	3,25,000	0.40	2.00	65,000	
				1,40,000	

Total number of hours required are 1,40,000. Available hours are 1,30,000. Therefore, overtime allowance will have to be paid for 10,000 hours (i.e., 1,40,000 Hrs. - 1,30,000 Hrs.)

(a) Estimate for the next year in respect of contribution from each product and the net income of the company, when overtime is paid

(i) Statement showing the marginal cost per unit of each product :

Doll's name	Standard material cost per unit	Standard labour cost per unit	Variable cost (50% of std. (D.L. cost)	Marginal cost for each product
Dolly	Rs. 1.40	Rs. 0.80	Rs. 0.40	Rs. 2.60
Molly	0.70	0.50	0.25	1.45
Jolly	2.70	1.40	0.70	4.80
Polly	1.00	1.00	0.50	2.50
Sewing kit	0.60	0.40	0.20	1.20

(ii) Statement showing the total contribution from each product :

Doll's name	Selling price per unit	Marginal cost per unit	Contribution per unit	No. of units	Total contribution
Dolly	Rs. 5.20	Rs. 2.60	Rs. 2.60	50,000	Rs. 1,30,000
Molly	2.40	1.45	0.95	42,000	39,900

Jolly	8.50	4.80	3.70	35,000	1,29,500
Polly	4.00	2.50	1.50	40,000	60,000

Sewing kit :

at reduced price	2.55	1.20	1.35	1,67,000	2,25,450
at normal price	3.00	1.20	1.80	1,58,000	2,84,400

Total contribution from all the products Rs. 8,69,250

Less : Fixed cost :

Factory	Rs. 30,000
Administration	20,000
Selling and Distribution	50,250
	<u>1,00,250</u>
	7,69,000

Less : Overtime premium for 10,000 labour hours @ Rs. 2* per hour 20,000

Net income if work is done on overtime 7,49,000

* It is stated that overtime work is paid at double the normal rate. In other words, normal rate is Rs. 2.00 per hour and overtime premium is also Rs. 2.00 per hour. Overtime work is, thus, paid at double the normal rate. Wages at normal rate for 10,000 hours have already been included in Marginal Cost Statement. Therefore, overtime premium @ Rs. 2 per hour for overtime worked should be deducted from the contribution for arriving at the net income.

(b) Estimate for the next year in respect of contribution per labour hour and the net income of the company if overtime is not paid

The labour hours required for achieving the production target are 1,40,000 hrs. But the available labour hours are 1,30,000 only as the overtime work cannot be arranged due to industrial problem. It is, therefore, necessary to find out the contribution per labour hour. Contribution per labour hour for each product is worked out as under :

Product	Unit labour cost	Labour hour required col. 2 ÷ labour rate per hour, i.e., Rs. 2	Contribution per unit	Contribution per hour (4 ÷ 3)
1	1	3	4	5
Dolly	Rs. 0.80	0.40	Rs. 2.60	Rs. 6.50
Molly	0.50	0.25	0.95	3.80

Jolly	1.40	0.70	3.70	5.29
Polly	1.00	0.50	1.50	3.00
Sewing kit	0.40	0.20	1.35 1.80	6.75 9.00

The above statement shows that Polly has the lowest contribution per labour hour. This is the only product where production has to be reduced so as to effect a saving of 10,000 labour hours. It requires 0.50 hour for each unit of Polly. So, for saving 10,000 labour hours, the production of Polly will have to be reduced by 20,000 units. The revised number of dolls to be sold will be :

Product (Dolls)	No. of units
Dolly	50,000
Molly	42,000
Jolly	35,000
Polly	20,000 (40,000 units — 20,000 units)
Total Dolls	1,47,000

Sewing kit at reduced rate of Rs. 1.35 for each kit will be sold along with 1,47,000 dolls and the remaining kits (1,78,000 number) will be sold at normal rate of Rs. 3.00 each kit. The revised total contribution will be as under :

Product	Contribution per unit	No. of units to be sold	Total contribution
Dolly	Rs. 2.60	50,000	Rs. 1,30,000
Molly	0.95	42,000	39,900
Jolly	3.70	35,000	1,29,500
Polly	1.50	20,000	30,000
Sewing kit at reduced rate	1.35	1,47,000	1,98,450
Sewing kit at normal rate	1.80	1,78,000	3,20,400
Total contribution for all products			8,48,250
Less : Fixed costs			1,00,250
Revised net income			7,48,000

In this case, the revised net income has come down by Rs. 1,000 as compared to earlier proposal.

Profitability of Optimum Product mix ; Sales being Limiting Factor

Problem 9'51. The operating results of B.M. Ltd., for the year 1981 were as under :

<i>Sales mix : Product</i>	<i>Sales mix %</i>	<i>P/V Ratio %</i>
<i>A</i>	40	20
<i>B</i>	10	6
<i>C</i>	30	12
<i>D</i>	20	10

Total sales value of all the products was Rs. 80 lacs. Total fixed overheads amounted to Rs. 10 lacs. Raw Material contents of each product represented 50% of the respective variable cost. The forecast for the year 1982 is as under :

- (i) The raw material costs will go up by 10%.
- (ii) The company has been able to obtain export quota of raw material of the value of Rs. 35 lacs.
- (iii) The maximum sale potential of any of the above four products is 40% of the 1981 sales value.
- (iv) The company expects to secure an increase of 5% in the selling prices of all the products uniformly.

Required :

- (A) Prepare a statement showing the profitability of 1981
 - (B) Set a product mix to maximise profit in 1982.
 - (C) Prepare a statement showing the profitability of 1982.
- (I.C.W.A., Final, June 1983)

Solution : (A)

<i>Product</i>	<i>Sales mix</i>	<i>Sales value</i>	<i>P/V Ratio</i>	<i>Contribution</i>
<i>A</i>	40%	32,00,000	20%	6,40,000
<i>B</i>	10	8,00,000	6	48,000
<i>C</i>	30	24,00,000	12	2,88,000
<i>D</i>	20	16,00,000	10	1,60,000
	100	80,00,000		11,36,000
		Less : Fixed Expenses		10,00,000
		Profit for 1981		1,36,000

(B) Statement showing Contribution as percentage of Raw Material

Pro- ducts	Sales Rs.	Percentage of variable cost (100— P/V ratio)	Variable cost Rs.	Raw material 50% of v. cost Rs.	Contri- bution Rs.	Contri- bution as % of raw material
A	32,00,000	80%	25,60,000	12,80,000	6,40,000	50.00
B	8,00,000	94%	7,52,000	3,76,000	48,000	12.76
C	24,00,000	88%	21,12,000	10,56,000	2,88,000	27.27
D	16,00,000	90%	14,40,000	7,20,000	1,60,000	22.22
	<u>80,00,000</u>					

∴ Ranking for selection should be follows :

I	A
II	C
III	D
IV	B

Optimum product mix at 1981 costs

Pro- duct	Sales mix	Sales	Variable cost	Raw material (50% of V. cost	Raw material with 10 % increase
A	40%	Rs. 32,00,000	Rs. 25,60,000 (80% of S.V.)	Rs. 12,80,000	Rs. 14,08,000
B	—	—	—	—	—
C	40%	32,00,000	28,16,000 (88% of S.V.)	14,08,000	15,48,800
D	20%	16,00,000	14,40,000 (90% of S.V.)	7,20,000	7,92,000
		<u>80,00,000</u>			<u>37,48,800</u>

But the company can import material of Rs. 35 lakhs only.

Pro- duct	Raw material	Raw material before 10% price increase	Variable cost	Sales value at 1981 price	Sales after 5% increase
	Rs.	Rs.	Rs.	Rs.	Rs
A	14,08,000	12,80,000	25,60,000	32,00,000	33,60,000
C	15,48,800	14,08,000	28,16,000	32,00,000	33,60,000
D	5,43,200	4,93,818	9,87,636	10,97,373*	11,52,243
	<u>35,00,000</u>				<u>78,72,243</u>

*9,87,636 × 100 = Rs. 10,97,373.
90

(C) Statement showing profitability of 1982

Product	Sales	Raw material	Other variable cost (Refer to note 1)	Total variable cost	Contribution
	Rs.	Rs.	Rs.	Rs.	Rs.
A	33,60,000	14,08,000	12,80,000	26,88,000	6,72,000
B	—	—	—	—	—
C	33,60,000	15,48,800	14,08,000	29,56,800	4,03,200
D	11,52,243	5,43,200	4,93,818	10,37,018	1,15,225
	<u>78,72,243</u>		<u>31,81,818</u>	<u>66,81,818</u>	<u>11,90,425</u>
					<u>10,00,000</u>
					<u>1,90,425</u>

Note 1

Product A—Total Variable Cost	25,60,000
Less : Material Cost before revision	12,80,000
	<u>12,80,000</u>
Product C—Total Variable Cost	28,16,000
Less : Material Cost before revision	14,08,000
	<u>14,08,000</u>
Product D—Raw material cost after revision of material price	Rs. = 5,43,200
Corresponding material price before price increase of 10% = $(5,43,200 \times 100/110)$	= 4,93,818
Since Material cost is 50% of variable cost, remaining variable cost will be	= <u>4,93,818</u>

Optimum product mix subject to minimum production before/after conversion of machines into multipurpose

***Problem 9.52.** A firm has two machines, namely, machine 'P' and machine 'Q'. Machine 'P' can be used for the production of either product 'A' or product 'B' or both. Machine 'Q' can be used for the production of either product 'X' or product 'Y' or both. In order to maintain customer relations a minimum quantity of 1,500 units each of 'A' and 'B' and 1,200 units each of 'X' and 'Y' should be produced by the firm.

The production and cost data for 1984 are as under :

Machine hours available 'P' 4,500 hours

'Q' 5,100 hours

	Products			
	A	B	X	Y
Machine used	P	P	Q	Q
Machine hours required per unit of output	1.0	1.25	1.25	0.8
Selling price per unit	Rs. 200	Rs. 250	Rs. 300	Rs. 256
Direct materials per unit	80	100	100	80
Direct labour per machine hour	90	80	100	125
Variable overhead per machine hour	12	12	20	20

Fixed overheads are Rs. 4 lacs per annum. An additional expenditure involving a fixed overhead of Rs. 25,000 per annum will convert the machine P and Q into a versatile centre such that any four of the products can be manufactured on these two machines. The rate of output on these machines and direct wage rate will, however, remain the same. Required :

- (i) Set an optimal product mix subject to minimum market commitments both before and after the conversion of the machines into a versatile centre.
- (ii) Evaluate the profitability under the two sets of product mixes.
- (iii) Advise the management whether the conversion of machine should be undertaken or not. (CA Final, Nov. 1984)

Solution : Statement showing basic cost information about the products

	Products			
	A	B	X	Y
Selling Price	Rs. 200	Rs. 250	Rs. 300	Rs. 256
Direct material	80	100	100	80
Direct labour	90	100	125	100
Variable overhead	12	15	25	16
	182	215	250	196
Contribution	18	35	50	60
Machine hours per unit of output	1.0	1.25	1.25	0.8
Contribution per machine hour	18	28	40	75

(i) (a) Optimum product mix before conversion of machine into a versatile machine.

	A	B	X	Y
Minimum units required to be produced	1,500 units	1,500 units	1,200 units	1,200 units
Machine hours required for producing minimum units	1,500 hrs.	1,875 hrs.	1,500 hrs.	960 hrs.
Maximum hours available for machine P			4,500 hrs.	
Less : Hours spent for producing : Minimum units required for A and B, i.e., (1,500 hrs + 1,875 hrs.)			3,375 hrs.	
Balance hours			1,125 hrs.	

These 1,125 hours should be used for production of B which has better contribution to machine hour ratio.

∴ Additional units of B to be produced by utilization of 1,125 hrs. (1,125 hrs. ÷ 1.25)	⇒ 900 units
Maximum hours available for machine Q	5,100 hrs.
Less : Hours spent for producing minimum units required for X and Y, i.e., (1,500 hrs. + 960 hrs.)	2,460 hrs.
Balance hours	2,640 hrs.

These 2,640 hours should be utilized for production of Y which has better contribution to machine hour ratio,

∴ Additional units of Y to be produced by utilizing 2,640 hrs. (2,640 hrs. ÷ 0.8)	= 3,300 units
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∴ Optimum product mix before conversion of machine into a versatile machine will be :

A	1,500 units
B	2,400 units i.e., (1,500 + 900)
X	1,200 units
Y	4,500 units i.e., (1,200 + 3,300)

(b) Optimum product mix after the conversion of machine P and Q into a versatile centre.

Statement showing hours spent for producing minimum units

<i>Units</i>	<i>Hours</i>	<i>Working</i>	<i>Hours Spent</i>
<i>A</i>	1,500	$1,500 \times 1.00$	1,500
<i>B</i>	1,500	$1,500 \times 1.25$	1,875
<i>C</i>	1,200	$1,200 \times 1.25$	1,500
<i>D</i>	1,200	$1,200 \times 0.8$	960
			<hr/> 5,835 <hr/>

Total hours available for utilization

Machine *P* 4,500 hrs.Machine *Q* 5,100 hrs.

9,600

∴ Balance hours available to be used for versatile centre are 3,765 i.e., 9,600—5,835. These hours should be utilized for production of 'Y' which has maximum contribution to machine hours ratio :

∴ Additional units of 'Y' to be produced by utilizing 3,765 hrs. ($3,765 \div 0.8$) 4,706 units

∴ Optimum mix of versatile centre is

A 1,500 units*B* 1,500 units*X* 1,200 units*Y* 5,906 units, i.e., 1,200 + 4,706

(ii) Profitability under two sets of product mixes :

Before Conversion

	<i>Products</i>				<i>Total</i>
	<i>A</i>	<i>B</i>	<i>X</i>	<i>Y</i>	
Sales (Units)	1,500	2,400	1,200	4,500	
Selling price per unit	Rs 200	Rs 250	Rs. 300	Rs. 256	
Sales	3,00,000	6,00,000	3,60,000	11,52,000	24,12,000
Variable costs	2,73,000	5,16,000	3,00,000	8,82,000	19,71,000
Contribution	27,000	84,000	60,000	2,70,000	4,41,000
Fixed expenses					4,00,000
Profit					<hr/> 41,000 <hr/>

After Conversion

	<i>Products</i>				<i>Total</i>
	<i>A</i>	<i>B</i>	<i>X</i>	<i>Y</i>	
Sales (Units)	1,500	1,500	1,200	5,906	
Selling price per unit	Rs. 200	Rs. 250	Rs. 300	Rs. 256	
Sales	3,00,000	3,75,000	3,60,000	15,11,936	25,46,936
Variable cost	2,73,000	3,22,500	3,00,000	11,57,076	20,53,076
Contribution	27,000	52,500	60,000	3,54,360	4,93,860
Fixed overhead—Original					4,00,000
—Additional capital outlay					25,000
Total Fixed overhead					4,25,000
Profit					68,860

(iii) It is obvious from the above analysis that company should convert machines into a versatile centre.

Most profitable product-mix, labour being in short supply

Problem 9.53 The directors of ABC Ltd., manufacturers of products A, B and C, have asked for advice on the product mix of the company. The following information is given :

	<i>Products</i>		
	<i>A</i>	<i>B</i>	<i>C</i>
<i>Standard cost per unit :</i>			
Direct material	Rs. 20	Rs. 60	Rs. 40
Variable overhead	6	4	10
<i>Direct labour :</i>			
	Rate/Hr.	Hrs.	Hrs.
Department 1	Rs. 1	28	16
2	Rs. 2	5	6
3	Rs. 1	16	8
Current production per annum (units)	10,000	5,000	6,000
Selling price per unit	Rs. 100	136	180
Forecast of sales for the next year	12,000	7,000	9,000
Fixed overhead per annum	Rs. 4,00,000		

Further, the type of labour required by Department 2 is in short supply and it is not possible to increase the manpower of this department beyond its present level.

You are required to prepare a statement showing the most profitable mix of the product to be made and sold. The statement which should be presented in two parts should show :

- (i) the profit expected on the current budgeted production, and
- (ii) the profit which could be expected if the most profitable mix was produced.

[I.C.W.A. (F), Dec. 1983 : C.A. Final, Nov. 1978]

Solution : (i) Statement showing the profitability of the current budgeted production

Details	Products			Total
	A 10,000	B 5,000	C 6,000	
1. Selling price per unit	Rs. 100	Rs. 136	Rs. 180	Rs.
2. Variable cost per unit :				
Direct material	20	60	40	
Variable overhead	6	4	10	
Direct labour :				
Department 1	28	16	30	
2	10	12	20	
3	16	8	30	
Total of 2	80	100	130	
3. Contribution (1— 2)	20	36	50	
4. Total contribution	2,00,000	1,80,000	3,00,000	6,80,000
5. Fixed cost				4,00,000
6. Profit				2,80,000
7. Key factor (Labour times of Department 2)—hours	5	6	10	
8. Contribution per hour	Rs. 4	Rs. 6	Rs. 5	
9. Ranking	(3)	(1)	(2)	

The total production hours available should be utilized in the order of products B, C and A. The total production hours in Department 2 available have been worked out as under

Product	Production (units)	Labour hours of Department 2	Total production hours utilized in Department 2
A	10,000	5	50,000
B	5,000	6	30,000
C	6,000	10	60,000
			1,40,000

These available hours can be utilized according to the ranking, i.e., products B, C and A.

Product	Estimated production (units)	Labour hours of Department 2	Estimated total production hours utilized
B	7,000	6	42,000
C	9,000	10	90,000
A	1,600	5	8,000 (balance)
			<u>1,40,000</u>

(ii) Statement showing the estimated profitability of most profitable Mix

Details	Products			Total
	A	B	C	
Estimated production (units)	1,600	7,000	9,000	
Contribution per unit as in (i)	Rs. 20	Rs. 36	Rs. 50	
Total contribution	32,000	2,52,000	4,50,000	7,34,000
Less : Fixed cost				4,00,000
Profit				<u>3,34,000</u>

It is noticed that the estimated total contribution has gone up from Rs. 6,80,000 to Rs. 7,34,000.

Profitability due to discontinuance of one of the products

Problem 9 54. The costs per unit of the three products A, B and C of a Company are given below :

	Products		
	A	B	C
Direct materials	Rs. 20	Rs. 16	Rs. 18
Direct labour	12	14	12
Variable expenses	8	10	6
Fixed expenses	6	6	4
	<u>46</u>	<u>46</u>	<u>40</u>
Profit	18	14	12
	<u>64</u>	<u>60</u>	<u>52</u>
Selling price			
No. of units produced	10,000	5,000	8,000

Production arrangements are such that if one product is given up the production of the others can be raised by 50%. The directors propose that *C* should be given up because the contribution from that product is the lowest. Present suitable analysis of the data indicating whether the proposal should be accepted. *(I.C.W.A. Final, Dec. 1983)*

Solution : It is given in the problem that the directors proposed dropping product *C* because it had least contribution. Therefore, for finding out the contribution from each product :

	<i>Products</i>		
	<i>A</i>	<i>B</i>	<i>G</i>
Production (units)	10,000	5,000	8,000
Selling price per unit	Rs. 64	Rs. 60	Rs. 52
Less : Variable costs	40	40	36
Contribution per unit	24	20	16

It is noticed that contribution from product *C* is the lowest. But unit contribution will not affect the decision. Therefore, total contribution should be found out.

Total contribution—Product <i>A</i>	Rs. 2,40,000
Product <i>B</i>	1,00,000
Product <i>C</i>	1,28,000
Total	4,68,000
Less : Total fixed expenses Product <i>A</i>	Rs. 60,000
Product <i>B</i>	30,000
Product <i>C</i>	32,000
	1,22,000
Profit	3,46,000

It is necessary to find out the total contribution if one of the products is discontinued.

	<i>Products</i>			<i>Total</i>
	<i>A</i>	<i>B</i>	<i>C</i>	
<i>If product C is discontinued</i>				
Production (units)	10,000	5,000	—	
Additional units	5,000	2,500	—	
Total production	15,000	7,500		

Total contribution (Production × Unit contribution)	Rs. 3,60,000	Rs. 1,50,000	—	Rs. 5,10,000
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If product B is discontinued

Production (units)	10,000	—	8,000	
Additional units	5,000	—	4,000	
Total production	15,000	—	12,000	
Total contribution	Rs. 3,60,000	—	1,92,000	5,52,000

If product A is discontinued

Production (units)	—	5,000	8,000	
Additional units	—	2,500	4,000	
Total production		7,500	12,000	
Total contribution		Rs. 1,50,000	Rs. 1,92,000	3,42,000

The above analysis shows that if product B is discontinued, it will result in maximum total contribution of Rs. 5,52,000. Therefore, the proposal to discontinue product C should not be accepted. Discontinuance of product B is the most favourable decision.

Note. As there is no change in fixed cost in the three alternatives, the same will not affect the decision.

Income statement of optimum product mix with two constraints—Direct labour and minimum level of production

Problem 9-55. AB Ltd., manufactures three products X, Y and Z. Standard selling prices and costs have been established for 1985 as follows :

	Per unit		
	X	Y	Z
Selling price	Rs. 28	Rs. 60	Rs. 125
Direct materials	8	15	20
Direct wages	10	20	50
Variable overheads	5	10	25

Direct wages are paid at the rate of Rs 2 per hour in each case. Fixed overheads are budgeted at Rs. 25,000 for the coming year.

In the short run, the company cannot increase its direct labour strength and as a result, only 35,000 direct labour hours will be available in the coming year. The company has commitments to produce 500 units of each product.

It has been suggested that after meeting the minimum requirements for X, Y and Z, the balance of available direct labour hours should be used to produce product Z.

You are required : (a) to prepare an income statement showing the expected results if the proposal is adopted.

(b) Comment on the statement you have produced in (a) and prepare an income statement for any alternative policy which you consider would be more profitable.

(c) Basing your calculations on your suggestion in (b), show the company's break-even point in terms of units and sales value.

(d) Show the sale value which is required to produce an after tax return of 10% on capital employed of Rs. 1,00,000 assuming tax rate of 50%.
(J.C.W.A. Final, Dec. 1985)

Solution :

(a) Statement showing the Income of AB Ltd., for 1985

	Per unit		
	X	Y	Z
1. Selling price	Rs. 28	Rs. 60	Rs. 125
2. Variable costs :			
Direct materials	8	15	20
Direct wages @ Rs. 2 per hour	10	20	50
Variable overheads	5	10	25
Total of 2	23	45	95
Contribution (1-2)	5	15	30
Direct labour hours per unit	5	10	25
Contribution per labour hour	Rs. 1'00	Rs. 1'50	Rs. 1'20

It is given that the company has committed to production of 500 units of each product and the limiting labour hours are 35,000. Keeping in view these factors, the profitability will be as under :

Product	Production (units)	Contribution per unit	Ranking	Total contribution	Total direct labour hours
X	500	Rs. 5	3	2,500	2,500
Y	500	15	2	7,500	5,000
Z	500	30	1	15,000	12,500
Total				25,000	20,000

The remaining 15,000 hours should be utilized to produce Z, whose contribution per unit is maximum

600	30	18,000	15,000
Total contribution		43,000	35,000
Less : Fixed Cost		25,000	
Net profit		18,000	

(b) The limiting factor is direct labour hours.

The remaining 15,000 direct labour hours should be utilized for the product which gives maximum contribution per labour hour. Product Y gives the maximum contribution per labour hour. Therefore, production of Y will be 1,500 units (15,000 hour ÷ 10)

	<i>Total Contribution</i>	<i>Total labour hours</i>
Total as (a) above	Rs. 25,000	20,000
1,500 units @ Rs. 15 per unit	22,500	15,000
Total	47,500	35,000
Less : Fixed cost	25,000	
Net profit	22,500	

Under this alternative the total contribution has gone up by Rs. 4,500. Therefore, the remaining 15,000 labour hours should be used for product Y.

(c) Company's break-even point in terms of units and sales

It is given in the problem that the company has to produce 500 units of each product. At break-even point, the contribution is just sufficient to meet fixed cost. The fixed cost is Rs. 25,000. According to ranking, first product Z should be produced ; followed by products Y and X.

Contribution from these products :

	<i>Production (units)</i>	<i>Contribution per unit</i>	<i>Total contribution</i>
Z	500	30	15,000
Y	500	15	7,500
X	500	5	2,500
			25,000

The fixed cost is also Rs. 25,000. Therefore, the company's break-even sales are Rs. 25,000 by producing 500 units of products Z, Y and X.

(d) Capital employed	=Rs. 1,00,000
Desired return @ 10% on C.E.	=Rs. 10,000 after tax
Tax	= 10,000
	<hr/>
Gross return	20,000
Suppose return before tax	= 100
Less : Tax	50
	<hr/>
Profit after tax	50
	<hr/>

As at (c) above, the company has to produce 500 units of each product to break even. The remaining 15,000 labour hours must be utilized to produce product Y, which gives highest contribution per hour. Therefore, for finding the sales value for obtaining 10% return on capital employed, the gross return should be divided by contribution per unit of product Y.

Desired gross return	=Rs. 20,000
Contribution per unit of Y	=Rs. 15
Number of additional units to be produced	=Rs. 20,000 ÷ Rs. 15 = 1333.33

∴ Total sale value will be :

Product X 500 units @ Rs. 28	=Rs. 14,000
Product Y 1833.33 units (500 + 1333.33) @ Rs. 60	=Rs. 1,10,000
Product Z 500 units @ Rs. 125	=Rs. 62,500
	<hr/>
Total sales	1,86,500
	<hr/>

Profitability of optimum product-mix with minimum and maximum area to be cultivated

Problem 9'56. A company engaged in plantation activities, has 200 hectares of virgin land which can be used for growing jointly or individually tea, coffee and cardamom. The yield per hectare of the different crops and their selling prices per kg. are as under :

	Yield	Selling price per kg.
Tea	2,000 kg	Rs. 20
Coffee	500	40
Cardamom	100	250

The relevant cost data are given below :

(a) Variable cost per kg.

	Tea	Coffee	Cardamom
	Rs. 8	Rs. 10	Rs. 120
Labour charges	2	2	10
Packing materials	4	1	20
Other costs			
Total cost	14	13	150

(b) Fixed costs per annum

Cultivation and growing cost	Rs. 10,00,000
Administration cost	2,00,000
Land revenue	50,000
Repair and maintenance	2,50,000
Other costs	3,00,000
Total fixed costs	18,00,000

The policy of the company is to produce and sell all the three kinds of products and the maximum and minimum area to be cultivated per product is as follows :

	Maximum	Minimum
Tea	160 hectares	120 hectares
Coffee	50	30
Cardamom	30	10

Calculate the most profitable product-mix and the maximum profit which can be achieved. (I.C.W.A. Inter, Dec. 1985, (C.S. Inter, 1988))

Solution : Statement showing the profitability of three products

	Tea	Coffee	Cardamom
Selling price per kg.	Rs. 20	Rs. 40	Rs. 250
Less : Variable cost per kg.	14	13	150
Contribution/kg.	6	27	100
P/V ratio	30%	67.5%	40%
Yield per hectare (kg.)	2,000	500	100
Contribution per hectare	12,000	13,500	10,000
Ranking	II	I	III

Optimum product-mix

	Area (hectare)	Yield (kg/hectare)	Production (kg.)
(a) Coffee maximum	50	500	25,000
(b) Minimum of cardamom	10	100	1,000
(c) Remaining area for Tea	140	2,000	2,80,000
	200		3,06,000

Total contribution of the three products

Coffee 25,000 kg. @ Rs. 27	Rs. 6,75,000
Cardamom 1,000 kg. @ Rs. 100	1,00,000
Tea 2,80,000 kg @ Rs. 6	16,80,000
Total contribution	24,55,000
Less : Fixed cost	18,00,000
Net profit	6,55,000

Profitability of possible combination of price mix with and without spare capacity)

Problem 9.57. Sellaway Ltd., manufactures and markets two products A and B, the demand in the market of which fluctuates with the price quoted. As a result of the deliberation of its retail sales performance, the following data were agreed upon as a working base.

Product	A					
Selling price per unit	Rs. 32	30	28	26	24	18
Expected demand per month (Nos.)	900	1,000	1,500	1,600	2,000	3,000

8 labour hours are required to produce product A and 7 hours to produce product B and the maximum capacity of the factory is restricted to 20,000 labour hours per month.

The cost structure per unit of production is as follows:

Products	A	B
Direct material	Rs. 4	3
Direct labour	6	5
Variable overhead	10	6
	20	14

Fixed overheads are Rs. 32,400 per quarter.

You are required to compute the possible combinations and arrive at a proper price-mix for maximum profitability.

Also work out the profitable price mix in case the spare capacity can be fully utilized to meet additional demand of the product A and B in the ratio of 3 : 1.

(C.A. Final, Nov. 1985)

Solution : Statement showing the total contribution of Products A and B

Products	A			B		
1. Expected demand per month—Nos.	900	1,000	1,500	1,600	2,000	3,000
2. Labour hours per unit	8	8	8	4	4	4
3. Total labour hours required (1 × 2)	7,200	8,000	12,000	6,400	8,000	12,000
4. S.P. per unit (Rs.)	32	30	28	22	20	18
5. Variable cost per unit (Rs.)	20	20	20	14	14	14
6. Contribution per unit (Rs.)	12	10	8	8	6	4
7. Contribution per hr. (Rs.) (6 ÷ 2)	1.5	1.25	1	2	1.5	1
8. Total contribution (Rs.)	10,800	10,000	12,000	12,800	12,000	12,000

Statement showing the possible combination of price mix for optimum profitability

Product price mix		Contribution			Total labour hours required		
A	B	A	B	Total	A	B	Total
Rs.	Rs.	Rs.		Rs.			
32	22	10,800	12,800	23,600	7,200	6,400	13,600
32	20	10,800	12,000	22,800	7,200	8,000	15,200
32	18	10,800	12,000	22,800	7,200	12,000	19,200
30	22	10,000	12,800	22,800	8,000	6,400	14,400
30	20	10,000	12,000	22,000	8,000	8,000	16,000
30	18	10,000	12,000	22,000	8,000	12,000	20,000
28	22	12,000	12,800	24,800	12,000	6,400	18,400
28	20	12,000	12,000	24,000	12,000	8,000	20,000
28	18	12,000	12,000	24,000	12,000	12,000	24,000

The best price combination is : Product A—Rs. 28 and Product B—Rs. 22 ; which yields the maximum contribution of Rs. 24,800 by utilizing 18,400 labour hours. The total labour hours available are 20,000. Thus the unutilized labour hours are 1,600. This spare capacity can be fully utilized to meet additional demand of the Products A and B in the ratio of 3 : 1. It is assumed that additional production will be sold at the above price mix. 1,600 hours will be utilized—product A 1,200 hours and

Product *B* 400 hours. Additional production of Product *A* will be 150 units and product *B* 100 units. The contribution per unit at the above price mix is Rs. 8 for both products *A* and *B*. Therefore, the additional contribution will be (product *A* 150×8 + product *B* 100×8 = Rs. 2,000). The fixed overhead of Rs. 32,400 per quarter will not affect the above decision.

Profitability of optimum product mix with limited labour hours and minimum level of production

Problem 9.58. A small-scale manufacturing unit has employed skilled persons for doing pressing and welding operations on various products. The welders produce two different products, *W1* and *W2*. The press operators also produce two products, *P1* and *P2*. Due to specific skill requirements, the press operators can't do welding job and vice-versa. The labour hours and cost data in respect of the above 4 products are as under.

	Products			
	<i>W1</i>	<i>W2</i>	<i>P1</i>	<i>P2</i>
Hours per unit	4	4	5	2
Price per unit (Rs.)	50	50	80	65
Direct Material per unit (Rs.)	18	22	35	45
Direct Labour Rate per hour (Rs.)	4	4	4	4
Variable Overhead per unit (Rs.)	2	2	3	3

The unit incurs Rs. 50,000 per annum on fixed costs for producing the above products.

The available labour hours for welding are 20,000 and for pressing 16,000.

The unit has also observed that the market can absorb minimum 2,000 units of *W1*, 2,500 units of *W2*, 1,800 units of *P1* and 2,200 units of *P2*. The demand keeps on fluctuating. The manager of the shop has, therefore, suggested that the workers should be trained to do either of welding or pressing job so that any excess demand can be fulfilled. It is estimated that this decision will increase the burden of fixed costs by Rs. 5,000 per annum. Required :

(a) Present the figures of optimum product mix assuming that the minimum marketable quantity is produced before the workers are trained and after they are trained.

(b) Prepare profitability statement for optimum product mix under both the above conditions and recommend whether it is advisable to train employees.

(ICWA Final, June 1987)

Solution. (a) Optimum Product Mix Before Training

	Welding Department (20,000 hours)		Pressing (16,000 hours)	
	W_1	W_2	P_1	P_2
Contribution Per Unit				
S. Price	50	50	£1	65
Less : Variable cost				
Material	18	22	35	45
Labour, @ Rs. 4/hr.	16	16	20	8
Variable overhead	2	2	3	3
Contribution per unit (a)	14	10	22	9
Contribution per unit (b)	4	4	5	2
Contribution per unit of (a) labour Hours (b)	3.5	5	4.40	4.50
Ranking	A	B	B	A
Minimum Production	2,000	2,500	1,800	2,200
Labour Hours per unit production	8,000	9,000	5,000	4,400
Total labour hours spent at each department	18,000		13,400	
Remaining labour hours	2,000		500	
Which unit to produce	W_1		P_2	
How much will be produced	2,000/4 500 units		2,600/2 1,300 units	

So Production Mix comes to be :

$$W_1 : 2,000 + 500 = 2,500 \text{ units}$$

$$W_2 : = 2,500 \text{ units}$$

$$P_1 : = 1,800 \text{ units}$$

$$P_2 : 2,200 + 1,300 = 3,500 \text{ units}$$

Optimum product mix after training

After training the capacity will be taken as a whole at 36,000 labour hours and ranking as the basis of contribution per labour hour will be done among all the four products, since a workman can produce any one of them.

(Total capacity = 36,000 hours)

Minimum Production	W_1 2,000	W_2 2,500	P_1 1,800	P_2 2,200
Contribution per unit	14	10	22	9
Labour hours per unit	4	4	5	2
Contribution per hour	3.5	2.5	4.4	4.5
Ranking	III	IV	II	I
Hours spent on minimum production	8,000	10,000	9,000	4,400
Total labour hours spent on minimum production	31,400			
Remaining hours	4,600			
Product to be produced	P_2			
Units of P_2 in Remaining hours	$4,600/2 = 2,300$ units			

So product mix after training will be :

	Units
W_1	2,000
W_2	2,500
P_1	1,800
P_2	$2,000 + 2,300 = 4,300$

(b) Profitability Statement - Contribution Margin

Total contribution :				
	Mix	Units	Contribution	
W_1	2,000	×	14	28,000
W_2	2,500	×	10	25,000
P_1	1,800	×	22	39,600
P_2	4,300	×	9	38,700
				131,300
Less : Fixed Cost				50,200
Profit				81,100

Profitability statement—After training

Total contribution :					
	Mix	×	Cont./Unit.		
W_1	2,000	×	14	=	28,000
W_2	2,500	×	10	=	25,000
P_1	1,800	×	22	=	39,600
P_2	4,500	×	9	=	40,500
					<u>1,33,100</u>
Less : Fixed cost				(50,000	
Addl cost due to training				(5,000	
					<u>55,000</u>
					<u>78,100</u>
					<u>==</u>

Recommendation. It is not advisable to train employees as it will reduce profit by Rs. 3,000.

Profitability due to Change in Sales Mix

Problem 9-59. A multi-product Company has the following Costs and output data for the last year

	Product		
	X	Y	Z
Sales mix	40%	35%	25%
Selling price	Rs. 20	Rs. 35	Rs. 30
Variable cost per unit	10	15	18
Total fixed costs			1,50,000
Total sales			5,00,000

The Company proposes to replace product Z by product S. Estimated cost and output data are :

	X	Y	S
Sales mix	50%	30%	20%
Selling price	Rs. 20	Rs. 25	Rs. 28
Variable Cost/unit	10	15	14
Total fixed costs			1,50,000
Total sales			5,00,000

Analyse the proposed change and suggest what decision the Company should take. (I.C.W.A Inter, June 1987)

Solution : **Statement showing the profitability of existing Sales-mix**

Products	X	Y	Z	Total
Sales mix	40%	35%	25%	100%
Units sold *	10,000	5,000	4,167	

	Rs.	Rs.	Rs.	Rs.
Sales value	2,00,000	1,75,000	1,25,000	5,00,000
Sales price per unit	20	35	30	
Variable cost per unit	10	15	18	
Contribution per unit	10	20	12	
P/V ratio	50%	57.14%	40%	
Total contribution	1,00,000	1,00,000	50,000	2,50,000
Less : Fixed costs				1,50,000
Net profit				1,00,000
*Sales value ÷ Selling price per unit				

Statement showing the profitability after proposed changes

Products	X	Y	S	Total
Sales mix	50%	30%	20%	100%
Units sold	12,500	6,000	3,571	
	Rs.	Rs.	Rs.	Rs.
Sales value	2,50,000	1,50,000	1,00,000	5,00,000
Selling price per unit	20	25	28	
Variable cost per unit	10	15	14	
Contribution per unit	10	10	14	
P/V ratio	50%	40%	50%	
Total contribution	1,25,000	60,000	50,000	2,35,000
Less : Fixed costs				1,50,000
Net profit				85,000

The company should not opt for the proposed changes, because the decision will result in a drop of profit by Rs. 15,000.

MERGING THE TWO PLANTS

Close down a Factory or Renew the Lease

Problem 9.60. Fitwell Ltd., a large manufacturing company has three factories namely, factory A, factory B and factory C. All the three factories produce the same product which is sold at Rs. 375 per unit. The factory-wise estimates of operating results for 1986 are as under :

(Rs. in lakhs)				
Product	A	B	C	Total
Sales	300	1,200	600	2,100
Costs :				
Raw materials	75	350	145	570
Direct labour	75	280	140	495
Fy. overheads -- Variable	20	110	55	185
-- Fixed	40	120	60	220
Selling and distribution overheads -- Variable	23	70	40	133
-- Fixed	15	50	30	95
Admin. overheads	20	90	40	150
H.O. expenses	12	50	30	92
Total Costs	280	1,120	540	1,940
Profit	20	80	60	160

When the above estimates were under finalisation, the company's legal department advised that the lease of factory A was due to expire on 31st December, 1985 and that it should be renewed by enhancing the lease rent by Rs. 12 lakhs per annum. Since this enhancement will have a heavy impact on the profitability of the company, the management is constrained to examine the proposals which are as under :

- (i) Renew the lease and bear the impact
- (ii) Close down factory A, sell off the plant, machinery and stocks and liquidate all liabilities, including the staff and workers' retrenchment compensation from the sale proceeds which are sufficient for this purpose.

In order, however, to maintain the customer relations, the total planned output of the factory A will be transferred to either factory B or to factory C. Plant capacity is available at both the factories to take over the manufacture. The additional costs involved in the manufacture of the extra output so transferred in factories B and C are estimated as under :

	Factory B	Factory C
(a) Additional fixed overheads due to increased capacity utilization (per annum)	Rs. 50 lakhs	Rs. 40 lakhs
(b) Additional freight, selling and other overheads to produce and distribute the output to the present customers of factory A	Rs. 25 per unit	Rs. 35 per unit

You are required to prepare comparative statements of profitability in the aforesaid alternative courses of action and give your recommendation.
(C.A. Final, Nov. 1985)

Solution :

(i) **Profitability of the Proposal when Lease is Renewed**

(Rs. in lakhs)

	Factories			Total
	A	B	C	
1. Sales	300	1,200	600	2,100
2. Costs				
Raw materials	75	350	145	570
Direct labour	75	280	140	495
Variable Overheads—Fy.	20	110	55	185
— S & D	23	70	40	133
Total of 2	193	810	380	1,383
3. Contribution (S—V)	107	390	220	717
4. Fixed overheads				
— Factory	40	120	60	220
— S & D	15	50	30	95
— Admn.	20	90	40	150
— H.O. expenses	12	50	30	92
— Additional lease rent	12	—	—	12
Total of 4	99	310	160	569
Profit (C—F.O.)	8	80	60	148

The profit has dropped from Rs. 160 lakhs to Rs. 148 lakhs. This reduction in profit is due to additional lease rent of Rs. 12 lakhs. The P/V ratio of factory A is 36% and Factory B is 33%. Therefore, factory A cannot be shut down.

(ii) **Statement showing variable and fixed costs when the production of factory A is transferred either to factory B or to factory C**

(Rs. in lakhs)

Production transferred to factory B	Sales	Variable costs	Fixed costs
Factory A (transfer)	300	202.5 i.e., $(810 - 1,200 \times 300)$	—

	<u>Plant A</u>	<u>Plant B</u>
<i>Capacity utilization</i>	70%	60%
	(Rs. lacs)	(Rs. lacs)
Sales	150	90
Variable costs	105	75
Fixed costs	30	20

It has been decided to merge Plant 'B' and Plant 'A'. The additional fixed expenses involved in the merger amount to Rs. 2 lacs. Required :

(1) Find the break-even point of Plant 'A' and Plant 'B' before merger and the break-even point of the merged plant.

(2) Find the capacity utilisation of the integrated plant required to earn a profit of Rs. 28 lacs. (C.A. Inter, May 1983 ; Modified C.A., Final, May 1978 ; ICWA, (F.) June 1981)

Solution : Statement showing the break-even point of plant A and plant B before merger and the break-even point after merger

	<u>Plant A</u>		<u>Plant B</u>		<u>Add. Cost</u>	<u>Merged/ Integrated Plant A & B</u>
	70%	100%	60%	100%		
	Rs. lacs	Rs. lacs	Rs. lacs	Rs. lacs		Rs. lacs
Sales	150	214.3	90	150		364.3
Variable costs	105	150.0	75	125		276
Contribution	45	64.3	15	25		89.3
Fixed costs	30	30.0	20	20	2	52
P/V ratio	30%	30%	16.67%	16.67%		24.5%
B.E.P*	100 lacs		120 lacs			212.16 lacs

*B E. Sales \times P/V ratio = Fixed cost.

(ii) Sales (required) \times P/V ratio = Fixed cost + Profit
 Sales \times 24.51% = 52 lakhs + 18 lakhs
 Sales = 285.6 lakhs

Required capacity utilisation

$$= \frac{285.6 \text{ lakh}}{364.3 \text{ lakh}} \times 100 = 78.40\%$$

Problem 9-62 (Merging the two plants) Two manufacturing companies which have the following operating details decide to merge :

	Company 1	Company 2
Capacity utilization %	90	60
Sales (Rs. lakhs)	540	300
Variable Costs (Rs. lakhs)	396	225
Fixed Costs (Rs. lakhs)	80	50

Assuming that the proposal is implemented, calculate :

- Break-even sales of the merged plant and the capacity utilization at that stage.
- Profitability of the merged plant at 80% capacity utilization.
- Sales turnover of the merged Plant to earn a profit of Rs. 75 lakhs.
- When the merged Plant is working at a capacity to earn a profit of Rs. 75 lakhs what percentage increase in selling price is required to sustain an increase of 5% in fixed overheads.

(I.C.W.A. Inter December, 1987; C.A. Inter Nov. 1986—Similar)

Solution : The plants of company 1 and company 2 are operating at 90% and 60% capacity. Their costs and sales have to be first adjusted to 100% capacity.

	Company 1	Company 2	Total (merged plant)
1. Capacity utilization	100%	100%	100%
	(Rupees in lakhs)		
2. Sales	600	500	1,100
3. Variable costs	440	375	815
4. Contribution	160	125	285
5. Fixed Cost	80	50	130
6. Profit	80	75	155
7. P/V Ratio (Merged Plant)	$(285 \div 1100) \times 100$		25.91%
8. BEP of the Merged Plant	$(\text{Fixed cost} \div \text{P/V Ratio})$		Rs. 501.74
9. Capacity utilization at BEP	$(501.74 \div 1100) \times 100$		45.61%

- (ii) **Profitability of the merged plant at 80% capacity**

	Rs. lakhs
Sales $(1,100 \times 80\%)$	880
Variable cost	652
Contribution	228
Fixed cost	130
Profit	98
Profit as a % of Sales	11.14%

(iii) Sales required to earn a profit of Rs. 75 lakhs

Contribution required	= Fixed cost + desired profit
	= Rs. 130 lakhs + 75 lakhs = 205 lakhs
P/V Ratio	= 25.91%
Desired Sales Level	= Desired Contribution ÷ P/V Ratio
	= Rs. 205 lakhs ÷ 25.91%
	= Rs. 791.20 lakh

(iv) Percentage increase in S.P. to sustain 5% increase in F.O. (with Rs. 75 lakhs profit)

Fixed overhead	= Rs. 130 lakhs.
5% increase	= Rs. 6.5 lakhs.
Sales	= Rs. 791.20 lakhs.
% increase in S.P.	= $(6.5 \div 791.20) \times 100 = 0.8215\%$

MARGINAL COSTING Vs. ABSORPTION COSTING

Problem 9.63. WONDER Ltd. manufactures a single product, ZEST. The following figures relate to ZEST for a one-year period :

Activity level	50%	100%
Sales and production (units)	400	800
Sales (Rs. in lakhs)	8.00	Rs. 16.00
Production costs :		
Variable	3.20	6.40
Fixed	1.60	1.60
Selling and administration costs :		
Variable	1.60	3.20
Fixed	2.40	2.40

The normal level of activity for the year is 800 units. Fixed costs are incurred evenly throughout the year, and actual fixed costs are the same as budgeted. There were no stocks of ZEST at the beginning of the year.

In the first quarter, 220 units were produced and 160 units were sold. Required :

- What would be fixed production costs absorbed by ZEST if absorption costing is used ?
- What would be the under/over-recovery of overheads during the period ?
- What would be the profit absorption costing ?
- What would be the profit using marginal costing ?
- Why is there a difference between the answers to (c) and (d) ?

(C.A. Final, Nov. 1986)

Solution : (a) Fixed production costs absorbed by ZEST

Budgeted fixed production costs for the period	= Rs. 1,60,000
Normal level of activity for the period	= 800 units
Overhead recovery rate	= Rs. 1,60,000 ÷ 800 or Rs. 200 per unit

Fixed production overhead absorbed by ZESI during the first quarter = $220 \text{ units} \times \text{Rs. } 200 = \text{Rs. } 44,000$.

(b) Under/over-recovery of overheads during the quarter

Actual fixed overheads (one-fourth of Rs. 1,60,000)	Rs. 40,000
Absorbed fixed overheads (as above)	44,000
	<hr/>
Over-absorbed production overheads	4,000
	<hr/>

(c) Calculation of profit for the quarter using absorption costing

Sales ($160 \text{ units} \times \text{Rs. } 2,000$)	Rs. 3,20,000
Less : Cost of sales	
Production variable ($220 \times \text{Rs. } 800$)	Rs. 1,76,000
Fixed overhead absorbed ($220 \times \text{Rs. } 200$)	44,000
	<hr/>
Total production costs ($220 \times \text{Rs. } 1,000$)	2,20,000
Less : Closing stock ($60 \times \text{Rs. } 1,000$)	60,000
	<hr/>
Production cost of saleable units	1,60,000
Add : Selling and administration costs (variable) ($160 \times \text{Rs. } 400$)	64,000
Selling and administration costs (fixed) (one-fourth of Rs. 2,40,000)	60,000
Total cost of sales	<hr/>
	2,84,000
	<hr/>
Profit before adjustment	36,000
Adjustment for over-absorbed overhead	4,000
	<hr/>
Actual profit	40,000
	<hr/>

(d) Profit for the quarter under marginal costing

Sales	Rs.	Rs. 3,20,000
Variable production costs ($220 \times \text{Rs. } 800$)	1,76,000	
Less : Closing stock ($60 \times \text{Rs. } 800$)	48,000	
	<hr/>	
Variable production costs of saleable units	1,28,000	
Add : Variable selling and administration costs ($\text{Rs. } 160 \times \text{Rs. } 400$)	64,000	
Total variable cost of sales	<hr/>	1,92,000
		<hr/>
Contribution		1,28,000
Less : Fixed costs incurred		
Production	40,000	
Selling and administration	60,000	
	<hr/>	1,00,000
		<hr/>
Actual profit (under marginal costing)		28,000
		<hr/>

(e) Reasons for difference between profit under absorption costing and marginal costing

The profit under absorption costing is Rs. 40,000 and the profit under marginal costing is Rs. 28,000. Thus the difference in profit is Rs. 12,000, which is due to different methods of valuation of closing stock. Under absorption costing, closing stock of 60 units includes absorbed production fixed overhead of Rs. 12,000. These costs are carried over to the next quarter resulting in increase in profit. Under marginal costing, all fixed costs incurred in the period are charged against profit.

Relative effects on the monthly operating results—absorption costing and marginal costing

Problem 9.64. ABC Ltd manufactures only one product which are identical in every respect.

The following information relates to April and May 1986 :

(i) Budgeted costs and selling prices :

	<i>April</i>	<i>May</i>
Variable manufacturing cost per unit	Rs. 2.00	Rs. 2.20
Total fixed manufacturing cost (based on budget output of 25,000 units per month)	40,000	44,000
Total fixed marketing cost (based on budgeted sales of 25,000 units per month)	14,000	15,400
Selling price per unit	5.00	5.50

(ii) Actual production and sales achieved :

	<i>Units</i>	<i>Units</i>
Production	24,000	24,000
Sales	21,000	26,500

(iii) There was no stock of finished goods at the beginning of April 1986. There was no wastage or loss of finished goods during either April or May 1986.

(iv) Actual costs incurred corresponded to those budgeted for each month. Required :

Calculate the relative effects on the monthly operating profits of applying the following methods :

(i) absorption costing, and

(ii) marginal costing.

(I.C.W.A. Final, Dec 1986—Adapted)

Solution :

First of all find out the closing stocks for two months :

	<i>April</i>	<i>May</i>
Opening stock	—	3,000*
Production	24,000	24,000
	<u>24,000</u>	<u>27,000</u>
Less : Sales	21,000	26,500
Closing stock	<u>3,000</u>	<u>500</u>

*Closing stock for April becomes the opening stock for May.

Operating Profit under Marginal Costing

	<i>April</i>			<i>May</i>		
	<i>Units</i>	<i>Rate</i>	<i>Amount</i>	<i>Units</i>	<i>Rate</i>	<i>Amount</i>
		<i>Rs.</i>	<i>Rs.</i>		<i>Rs.</i>	<i>Rs.</i>
(i) Sales	21,000	5'00	1,05,000	26,500	5'50	1,45,750
(ii) Variable manufacturing cost	24,000	2'00	48,000	24,000	2'20	52,800
Add : Opening stock	—		—	3,000	2'00*	6,000
Total	24,000		48,000	27,000		58,800
Less : Closing stock	3,000	2'00	6,000	500	2'20	1,100
(iii) Variable manufacturing cost after stock adjustment	21,000		42,000	26,500		57,700
Contribution (i-- ii)			63,000			88,050
Less : Fixed cost :						
Manufacturing	40,000			44,000		
Marketing	14,000			15,400		
			54,000			59,400
Net profit			9,000			28,650

*Variable manufacturing cost for the previous month.

Operating Profit under Absorption Costing

(i) Sales	21,000	Rs. 5'00	1,05,000	26,500	5'50	1,45,750
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(ii) Cost of sales

Opening stock	—	3,000	3.60	10,800		
Production cost (V + F)	24,000	3.60	86,400*	24,000	3.96	95,040†
Closing stock	3,000	3.60	(10,800)	500	3.96	(1,980)
			<hr/>			<hr/>
Cost of production			75,600			1,03,860
Adjustment for under-recovery of overhead			1,600			1,760
			<hr/>			<hr/>
Total manufacturing cost after adjustment			77,200			1,05,620
			<hr/>			<hr/>
Gross profit (i—ii)			27,800			40,130
Less : Marketing cost			14,000			15,400
			<hr/>			<hr/>
Net profit			13,800			24,730
			<hr/>			<hr/>

*Variable $24,000 \times 2 = 48,000$

Fixed (manufacturing) $40,000 \times \frac{24}{25} = 38,400$

86,400

†Variable $24,000 \times 2.20 = 52,800$

Fixed (manufacturing) $44,000 \times \frac{24}{25} = 42,240$

95,040

Profit and Loss Account—Traditional form and contribution form

Problem 9 65. From the following data of Dorde Company you are required to prepare Profit and Loss Accounts in the traditional form as well as in the contribution form at :

Sales	Rs. 84,00,000
Depreciation, Supervisory Salaries and other fixed costs	18,00,000
Variable production costs	22,00,000
Operating expenses—Administration	16,00,000
Selling expenses	20,00,000

50% of Administration expenses and 40% of selling expenses are fixed.
(I.C.W.A. Inter, Dec. 1985)

Statement showing the Traditional Profit and Loss Account

Variable production cost (Rs. in lakhs)	22
Depreciation and other fixed costs	18

Factory costs	40
Administration expenses	16
	<hr/>
Cost of production	56
Selling expenses	20
	<hr/>
Total cost of sales	76
Sales	84
	<hr/>
Net Profit	8
	<hr/>

Statement showing the Profit and Loss Account in contribution form

Sales		Rs. 84 lakhs
<i>Less</i> : Variable costs :		
Production	22	
Administration (50% variable)	8	
Selling (60% variable)	12	
	<hr/>	42
Contribution		<hr/>
		42
<i>Less</i> : Fixed costs :		
Depreciation etc.	18	
Administration	8	
Selling	8	
	<hr/>	34
Net profit		<hr/>
		8
		<hr/>

Difference in profits—absorption costing and marginal costing

✓ **Problem 9-66. (Marginal Costing vs. Absorption Costing)**
 PH Ltd. has a productive capacity of 2,00,000 units of product BXE per annum. The company estimated its normal capacity utilisation at 90% for 1986-87. The variable costs are Rs. 22 per unit and the fixed factory overheads were budgeted at Rs. 7,20,000 per annum. The variable selling overheads amounted to Rs. 6 per unit and the fixed selling expenses were budgeted at Rs. 5,04,000. The operating data for 1986-87 are as under :

Production	1,60,000 units
Sales @ Rs. 40 per unit	1,50,000 units
Opening stock of finished goods	10,000 units

The cost analysis revealed an excess spending of variable factory overheads to the extent of Rs. 80,000. There are no variances in respect of other items of cost.

Required :

- (i) Determine the budgeted break even point for 1986-87.
- (ii) What increase in price would have been necessary to achieve the budgeted profit ?
- (iii) Present statements of profitability for 1986-87 using :
 - (a) Marginal costing basis.
 - (b) Absorption costing basis.

(I.C.W.A. Final, December 1987; C.A. Inter November 1983—Adapted)

Solution :

Budgeted BEP

S. Price		Rs. 40'00
V. Cost		
F.O.	22'00	
S.O.H.	6'00	28'00
		<hr/>
Contribution per unit as per budget		12'00
		<hr/>

Fixed Cost = Rs. 7,20,000 + Rs. 5,04,000 = Rs. 12,24,000

∴ BEP as per budget = $\text{Fixed O.H.} \div \text{Contribution per unit}$
 = 1,02,000 units

Note : Variable overhead expenditure variance is irrelevant to budgeted break-even point.

(ii) Sales as per budget = $1,80,000 \times 40$	Rs. 72,00,000
Less : Variable cost as per budget = $1,80,000 \times 28$	50,40,000
	<hr/>
Contribution as per budget	21,60,000
Less : Fixed cost	12,24,000
	<hr/>
Profit as per budget	9,36,000
	<hr/>

(iii) Statement of profitability for 1986-87 using Marginal Costing Method ,

Variable Production Cost $1,60,000 \times \text{Rs. } 22$	Rs. 35,20,000
Excess Cost	80,000
	<hr/>
Total Variable Production Cost	36,00,000
Less : Closing Stock	
$(36,00,000 \div 1,60,000) \times 20,000$	4,50,000
	<hr/>
Add : Opening Stock $10,000 \times 22$	31,50,000
	2,20,000
	<hr/>
Variable production cost of goods sold	32,30,000
S & D Exp. $(1,50,000 \times 6)$	9,00,000
	<hr/>

Total Variable Cost		42,70,000
Sales (1,50,000 × 40)		60,00,000
Contribution		17,30,000
Less : Fixed Cost		
Factory	Rs. 7,20,000	
S & D	5,04,000	12,24,000
Profit		5,06,000
		=====

Statement of profitability as per absorption method

Production Cost

Variable 1,60,000 × Rs. 22	=	Rs. 35,20,000
Excess Cost	=	80,000
Fixed Cost 1,60,000 × (7,20,000 ÷ 1,80,000)	=	6,40,000
Total Cost of production		42,40,000
Less : Closing Stock		
(42,40,000 ÷ 1,60,000) × 20,000		5,30,000
		37,10,000
Add : Opening Stock 10,000 × (22 + 4*)	=	2,60,000
		39,70,000

* Rs. 7,20,000 ÷ 1,80,000 units

Selling & Distribution OH

Variable 1,50,000 × 6	Rs. 9,00,000	
Fixed 1,50,000 × (5,04,000 ÷ 1,80,000)	4,20,000	13,20,000
Total Cost of Sales	=	52,90,000
Sales 1,50,000 × Rs. 40	=	60,00,000
Profit as per Absorption Costing	=	7,10,000
		=====

Reconciliation

Profit as per Absorption Costing	=	Rs. 7,10,000
Less : Closing stock's under-valuation Rs. (5,30,000 - 4,50,000)	=	80,000
		6,30,000
Add : Opening Stock Overvalued in absorption costing (Rs. 2,60,000 - Rs. 2,20,000)		40,000
		6,70,000
Less : Selling & Distribution OH over-recovered in marginal costing 5,04,000 - 4,20,000		84,000
		5,86,000

Less : Prod. Fixed Cost less charged in accounts 7,20,000—6,40,000	80,000
Profit as per Marginal Costing	<u>5,06,000</u>

Authors' Special Notes

1. When combined break-even analysis is required, find out total contribution at 100% capacity and relate it with total sales for overall P/V ratio (Problems P 9.1, 9.61 and 9.62)

2. *Problem 9.13.* Note (i) BEP cannot be in fraction, since candidates are involved, (ii) Cost behaviour changes after 1,110 candidates and (iii) Revised contribution per candidate comes to Rs. 20. observe how approach is adapted due to change in situation.

3. *Problem 9.17.* Note use of opportunity cost concept in CVP analysis, i.e., contribution lost for each new magazine.

4. *Problem 9.22* for use of concept of indifference point in CVP analysis.

5. It pays to prepare a schematic diagram in lengthy questions (Problem P 9.23 from CIMA, (London).

6. In comparison of results of Marginal Costing and Absorption Costing, note how to carry out adjustment of under/over-absorbed overhead (Problem P 9.63, 9.64, 9.66, 9.67)

7. Practise to concentrate on correct interpretation of language, keep a list of areas that duped the students on following pattern :

Problem P 9.33. "Trade discount is allowed 1% to overseas agent.....Export duty is payable 5% ad valorem..... Export incentive 16% of net selling price.....overseas agency".

Problem P 9.41. "As a result of reorganisation of production method, the overall direct labour efficiency will increase by 12% and wage will go up by 5%". This means, present wages $\times (100 \div 112) \times (105 \div 100)$.

Problem P 9.42. "Under a wage agreement, an increase of 10% is payable to all direct workers from the beginning of the forthcoming year, while material costs are expected to increase by 7.5% ; variable costs by 5% and fixed overhead cost 3%."

Problem 9.44. "Recommend a sales volume of each product, which will eliminate the expected losses on the assumption that the sales of only one product can be increased at a time."

BREAK-UP OF THE PROBLEMS RELATING TO MARGINAL COSTING & CVP ANALYSIS ACCORDING TO DIFFERENT LEVELS (FOR PROBLEMS WITH PR. FIX A, REFER TO APPENDIX A)

Intermediate Level

Break Even Analysis—P 9.1, 9.4, 9.5, 9.6, 9.8, 9.9, 9.10, 9.12, 9.13,

9-14, 9-16, 9-18, 9-22, A 21, A 27, A 30, A 43, A 69, A 82

Break Even Chart—P 9-24, 9-25

Key Factors—P 9-27, A 83

Effect of change in Cost, Volume and Price—P 9-34, 9-35, 9-36, 9-37, 9-38, 9-39, 9-40, 9-42, 9-43, A 8, A 170

Product Mix—P 9-47, 9-48, 9-49, 9-59, 9-56, A2, A6, A133, A149

Merging the two plants—P 9-61, 9-62

Marginal Costing vs. Absorption Costing — P 9-65, 9-66, A92, A116, A157

Final Level

Break-Even Analysis—P 9-2, 9-3, 9-7, 9-11, 9-15, 9-17, 9-19, 9-21, 9-23, A13, A 22, A 123

Break Even Chart—P 9-26

Key Factors—P 9-28, 9-29, 9-30, 9-31, 9-32, 9-33, A51, A65, A84, A109, A129

Effect of change in Cost Volume and Price—P 9-41, 9-44, 9-45, A 113

Product Mix—P 9-41, 9-50, 9-51, 9-52, 9-53, 9-54, 9-55, 9-57, 9-58, A 54, A 108, A 126.

Merging the two Plants—P 9-60

Marginal Costing vs. Absorption Costing — 9-63, 9-64, 9-66, A15, A124

Please also refer to Examples 10-1 to 10-27 of the book "Advanced Cost and Management Accounting—Text" by Saxena and Vashist.

Decision Making*

[Make or Buy Decision 10·1—10·7, Accepting/Quoting for an Order or Contract 10·8—10·13, Expand or Contract 10·14—10·15, Accepting or Rejecting an Export Order 10·16—10·21, Modernisation Decisions 10·22—10·26, Production Decisions 10·27—10·38, Marketing Decisions 10·39—10·45, Cost Indifference Point 10·46—10·47, Choice of Best Alternative 10·48—10·60]

MAKE OR BUY DECISIONS

Problem 10·1. Auto Parts Ltd., has an annual production of 90,000 units for a motor component. The component cost structure is as below :

Materials	Rs 270 per unit
Labour 25% fixed)	180 per unit
Expenses :	
Variable	90 per unit
Fixed	135 per unit
	<hr/>
Total	675 per unit
	<hr/>

(a) The purchase manager has an offer from a supplier who is willing to supply the component at Rs. 540. Should the component be purchased and production stopped ?

(b) Assume the resources now used for this component's manufacture are to be used to produce another new product for which the selling price is Rs. 485.

In the latter case the material price will be Rs. 200 per unit. 90,000 units of this product can be produced at the same cost basis as above for labour and expenses. Discuss whether it would be advisable to divert the resources to manufacture that new product, on the footing that the component presently being produced would, instead of being produced, be purchased from the market. (C.A. Inter, May 1982)

Solution :

Statement showing the Variable Cost and Purchase Cost of Component . . . used by Auto Parts Ltd.

Variable cost	Per unit	Total for 90,000 units
Materials	Per 270	Rs. 2,43,00,000
Labour	135	1,21,50,000
Expenses	90	81,00,000
	<hr/>	<hr/>

*This chapter requires limited emphasis by Intermediate level students based on trend analysis. For relevant problems, please refer to the note at the end of this chapter.

Total Variable Cost (when component is produced)	495	4,45,50,000
Cost of purchase (when component is purchased)	540	4,86,00,000
	<hr/>	<hr/>
Difference, excess of purchase price over variable cost	45	40,50,000
	==	=====

Fixed expenses are not being affected. It is evident from the above statement that if the component is purchased from the outside supplier, the company will have to pay Rs. 45·00 per unit more and on 90,000 units the company will have to spend Rs. 40,50,000 more. Therefore, the company should not stop the production of the component.

(b) The following statement shows the cost implications of the proposal to divert the available facilities for a new product.

Statement showing the Contribution per Unit if the Existing Resources are used for the Production of another New Product

	Selling price of new product per unit	Rs. 485
Less	Material cost	Rs. 200
	Labour (variable)	135
	Expenses (variable)	90
	<hr/>	<hr/>
	Contribution per unit	60
		<hr/>

Loss per unit if the present component is purchased :

	Purchase price of the existing product	540
Less :	Total variable cost of producing the existing component as shown in (a) above	495
		<hr/>
	Excess cost	45
		==

Thus, if the company diverts the resources for the production of another new product, it will benefit by Rs. 15, i.e., Rs. 60—45 per unit. On 90,000 units, the company will save Rs. 13,50,000. Therefore, it is advisable to divert the resources to manufacture the new product and the component presently being produced should be purchased from the market. This is also brought out by the following figures :

Total cost of producing the component (90,000 × 675)	(A)	Rs. 6,07,50,000
Cost of purchasing the component (90,000 × 540)		4,86,00,000
Fixed expenses not having been saved (90,000 × 180, i.e., 675 - 495)		1,62,00,000
		<hr/>

	6,48,00,000
Less : Contribution from the new product (90,000 × 60)	54,00,000
	<hr/>
Total cost if component is purchased and new product is made (B)	5,94,00,000
	<hr/>
Saving (A—B)	Rs. 13,50,000
	<hr/>

Production of a new product in spare capacity, Make or Buy Empty Tubes

Problem 10.2. A company manufacturing a highly successful line of cosmetics intends to diversify the product line to achieve fuller utilization of its plant capacity. As a result of considerable research made, the company has been able to develop a new product called "EMO".

EMO is packed in tubes of 50 gram capacity and is sold to the wholesalers in cartons of 24 tubes at Rs. 240 per carton. Since the company uses its spare capacity for the manufacture of EMO, no additional fixed expenses will be incurred. However, the cost accountant has allocated a share of Rs. 4,50,000 per month as fixed expenses to be absorbed by EMO as a fair share of the company's present fixed costs to the new product for costing purposes.

The company estimates the production and sale of EMO at 3,00,000 tubes per month and on this basis the following cost estimates have been developed :

	<i>Rs. per carton</i>
Direct materials	108
Direct wages	72
All overheads	54
	<hr/>
Total costs	234
	<hr/>

After a detailed market survey the company is confident that the production and sales of EMO can be increased to 3,50,000 tubes per month and ultimately to 4,50,000 tubes per month.

The company at present has a capacity for the manufacture of 3,00,000 empty tubes and the cost of empty tubes, if purchased from outside will result in a saving of 20% in material and 10% in direct wages and variable overhead costs of EMO. The price at which the outside firm is willing to supply the empty tubes is Rs. 1.35 per empty tube. If the company desires to manufacture empty tubes in excess of 3,00,000 tubes, new machine involving an additional fixed overheads of Rs. 30,000 per month will have to be installed. Required :

- (i) State by showing your working whether company should make or buy the empty tubes at each of the three volumes of production of EMO namely, 3,00,000, 3,50,000 and 4,50,000 tubes.

- (ii) At what volume of sales will it be economical for the company to install the additional equipment for the manufacture of empty tubes?
- (iii) Evaluate the profitability on the sale of EMO at each of the aforesaid three levels of output based on your decision and showing the cost of empty tubes as a separate element of cost.
- (C.A. Final, May 1985)

Solution :

(i) It is given that all overheads for a carton (i.e., 24 tubes of EMO) is Rs. 54.

∴ All overhead per tube = Rs. $54 \div 24$ or Rs. 2.25.

Fixed expenses for 3,00,000 tubes are Rs. 4,50,000

∴ Fixed overhead per tube = $\frac{\text{Rs. } 4,50,000}{3,00,000}$ or Rs. 1.50

∴ Variable overhead per tube = Rs. 2.25 - Rs. 1.50 or Re. 0.75.

Statement showing Cost per unit

Details	Cost per tube of EMO i.e., Empty tube + EMO Contents	Reduction in cost, if empty tubes are purchased from outside	Cost per empty tube	Cost of EMO contents only i.e., cost of tube with EMO minus cost of empty tube
Direct material (108 ÷ 24)	Rs. 4.50	20%	Re. 0.90	Rs. 3.60
Direct wages (72 ÷ 24)	3.00	10%	0.30	2.70
Variable overhead	0.75	10%	0.075	0.675
	8.25		1.275	6.975

Cost of Manufacturing 3,00,000 Empty Tubes of EMO

Details	Cost per empty tube	Cost if tubes are made	Cost, if tubes are purchased
Direct materials	Re. 0.90	Rs. 2,70,000	Rs.
Direct wages	0.30	90,000	
Variable overhead	0.075	22,500	
Purchase price	1.35		4,05,000
		3,82,500	4,05,000

It is beneficial for the company to manufacture for two reasons :

- Capacity exists to produce 3,00,000 empty tubes.
- Cost of manufacture is less than the cost of purchasing the empty tubes from market.

Capacity exists for manufacture of 3,00,000 tubes only. If company desires to manufacture empty tubes in excess of 3,00,000 tubes, a new machine involving an additional fixed overhead of Rs. 30,000 per month will have to be installed. The cost of making and buying additional tubes of 50,000 and 1,50,000 will be as under :

Cost Analysis for Additional Empty Tubes

Details	Cost per empty tube	50,000 tubes		1,50,000	
		Cost of making	Cost of buying	Cost of making	Cost of buying
Direct material	0.90	45,000		1,35,000	
Direct wages	0.30	15,000		45,000	
Variable overhead	0.075	3,750		11,250	
Additional fixed overhead		30,000		30,000	
Purchase price	1.35		67,500		2,02,500
		93,750	67,500	2,21,250	2,02,500

The above cost analysis for making/buying additional 50,000 or 1,50,000 empty tubes indicates that in both the cases company should buy additional tubes from outside market only. If 50,000 additional empty tubes are purchased from outside, then saving will be Rs. 26,250 i.e., Rs. 93,750 - Rs. 67,500. If 1,50,000 additional empty tubes are purchased from outside, then saving will be Rs. 12,250, i.e., Rs. 2,21,250 - Rs. 2,02,500.

- Volume of sales at which it will be economical for the company to install the additional equipment for the manufacture of empty tubes

Saving per unit if empty tubes are manufactured instead of buying :

$$\text{Rs. } 1.35 - \text{Rs. } 1.275 \text{ or Re. } 0.075.$$

Minimum additional quantity to be produced to cover additional fixed overhead of Rs. 30,000 \div $30,000 \div 0.075$ or 4,00,000 tubes.

The company will be justified to install the additional equipment for the manufacture of empty tubes at a sales volume of 7,00,000 tubes, i.e., 3,00,000 existing + 4,00,000 additional required so that saving in cost exceeds the capital outlay required for the machine.

(iii) Evaluation of profitability at three levels

Details	Cost per tube	3,00,000 tubes	3,50,000 tubes	4,50,000 tubes
Sales (240 ÷ 24)	10	30,00,000	35,00,000	45,00,000
Direct material	3.60	10,80,000	12,60,000	16,20,000
Direct wages	2.70	8,10,000	9,45,000	12,15,000
Variable overhead	0.675	2,02,500	2,36,250	3,03,750
Cost of manufacturing 3,00,000 empty tubes	1.275	3,82,500	3,82,500	3,82,500
Cost of buying additional units	1.35	—	67,500	2,02,500
Total of relevant cost* for evaluation of three levels		24,75,000	28,91,250	37,23,750
Excess of sales over relevant cost		5,25,000	6,08,750	7,76,250

Among these three levels, sales levels of 4,50,000 tubes is most profitable.

*Fixed cost has not been included under relevant cost, since it is the same in all situations.

Own manufacture or acceptance of quotation of purchased components

Problem 10.3. Watchwell T.V. Company manufactures various components in their machine shop which are assembled alongwith purchased components in an assembly shop. It is proposed by the production manager that an aluminium bracket which is manufactured in machine shop should be procured from outside party as the cost of production is very high due to rejections and also due to the recent wage agreement.

Mr Black : Basic price Rs. 5 per 1,000 Nos.
Excise duty at 12% ad valorem
Sales tax at 15%
Transport at Rs. 1.10 per 1,000 Nos.
Octroi at 2% on total bill.

Mr. White : Basic price Re. 0.75 per 1,000 Nos. (Labour charges only)
Material to be supplied by Watchwell.
Scrap generated in process will not be returned.
Transport at Re. 0.40 per 1,000 Nos.
Octroi at 2% on total price excluding material cost.
Rejection allowance at 2% of gross material cost.

The company gives you the following cost details for the brackets presently being manufactured :

Material cost per 1,000 Nos.	Rs. 6'00
Less : Scrap allowance	Rs. 2'00

Net material cost for 1,000 Nos.	Rs. 4'00

Conversion cost : The part is manufactured on a small press having machine hour rate of Rs. 30 per hour of which 10% is fixed cost. The standard time for producing 100 brackets is 0'6 minutes. Rejection is about 3% on works cost, Administration and selling overheads are 10% of works cost. The Production Manager has assured that the released press as well as the labour will be employed on alternative job. It is understood from purchased department that the excise duty paid on purchased component will be set-off against excise duty payable on T.V. Sets.

You are required to evaluate both the quotations and compare them with current costs assuming that the purchasing and storing as well as handling efforts are same in each case. Also give your recommendation as to the source of supply of the components. If the released capacity of press only is not utilised, will your recommendation change ?

Give your comments and assumptions in the evaluation wherever necessary.
(I.C.W.A. Final, June 1985)

Solution : Watchwell T.V. Company

Present Cost of Manufacturing Aluminium Brackets

Cost for 1,000 Nos.

Cost of material	Rs. 6'00
Less : Scrap allowance	2'00

Net material cost	4'00
Conversion cost	3'00*

Works cost	7'00
Rejections 3%	0'21

Total present cost	7'21
	==

*Standard time for 100 brackets	= 0'6 minutes
Standard time for 1,000 brackets	= 6 minutes
Machine hour rate	= Rs. 30
Machine charges for 6 minutes	= $(30 \div 60) \times 6 =$ Rs. 3'00.

Quotation from Mr. Black

	<i>Rs. for 1,000 Nos.</i>
Basic price	5 00
Excise duty 12%	0 60
	<hr/>
Total	5 60
Sales tax 15%	0 84
Freight	1 10
	<hr/>
Total	7 54
Octroi 2%	0 15
	<hr/>
Total price including octroi	7 69
Less : Excise duty set-off	0 60
	<hr/>
Net price	7 09
	<hr/>

Quotation from Mr. White

	<i>Rs. for 1,000 Nos.</i>
Material cost (scrap not returned)	6 00
Labour charges	0 75
Freight	0 40
Octroi (2% of labour and freight)	0 02
Rejection 2% of Rs. 6	0 12
	<hr/>
Total price	7 29
	<hr/>

The above computations show that quotation from Mr. Black is the lowest. Own cost of production is Rs. 7.21 as against price of Rs. 7.09 quoted by Mr. Black. Therefore, quotation submitted by Mr. Black should be accepted. In accepting this quotation due regard has been given to the assurance of production manager that released capacity of the press will be utilized and the labour will be deployed on alternative job. If it is not possible to utilize the excess press capacity, then the recommendation will be reversed. The effect of fixed cost will have to be added to the price quoted by Mr. Black or Mr. White. The fixed cost is 10% of conversion cost. Therefore, fixed cost will be 10% of Rs. 3.00 = Re. 0.30. Therefore, the revised quotation of Mr. Black will be Rs. 7.09 + Re. 0.30 = Rs. 7.39 which is more than the own manufactured cost of brackets. In this situation, it is recommended to manufacture the brackets in own factory.

Note : The administration and selling overheads are common to all the alternatives. Therefore, the same have been excluded from all the alternatives.

Make or Buy a component ; machine hour being limiting factor

Problem 10.4 You are the Management Auditor of XYZ Co. Ltd. The Managing Director of the company seeks your advice on the following problem :

The XYZ Ltd. produces a variety of products each having a number of component parts. Product "B" takes 5 hours to produce on a machine No. 99 working at full capacity. "B" has a selling price of Rs. 50 and a marginal cost of Rs. 30 per unit. "A-10" a Component part could be made on the same machine in 2 hours for a marginal cost of Rs. 5 per unit. The supplier's price is Rs. 12.50 per unit. Should the company make or buy "A-10" ?

Assume that machine hour is the limiting factor.

(J C.W.A. Final, June 1983)

Suggested Approach

In this situation cost of new product plus contribution lost during the time for manufacturing "A-10" should be compared with the supplier's price to arrive at the decision.

Solution :

"B"—Selling price	=	Rs. 50.00
Marginal cost	=	Rs. 30.00
		<hr/>
		Rs. 20.00
		<hr/>

It takes 5 hours to produce one unit of "B".

Contribution earned per hour on Machine No. 99 is Rs. $20 \div 5$
= Rs. 4.

"A-10" takes two hours to be manufactured on machine which is producing "B"

If "A-10" is produced, contribution lost will be
= 2 hrs. \times Rs. 4 = Rs. 8.

Real cost of "A-10" to the company = Marginal cost of "A-10" plus
Contribution lost for using the machine for "A-10"
= Rs. 5 + Rs. 8 = Rs. 13.

This is more than the seller's price of Rs. 12.50 and so it is advisable for the company to buy the product from outside.

Purchase components from outside or produce in second shift

Problem 10.5. A company manufacturing agricultural machinery is preparing its budget for the year 1984. An initial review shows that it will not be possible to manufacture all requirements for components A, B, C and D because the normal metal pressing capacity of 20,000 hours would be exceeded.

The company can choose between the alternative courses of action given below to obtain the products in excess of normal production capacity :

(i) to buy entirely from outside suppliers ;

(ii) to buy from outside suppliers and/or use a partial second shift.

The data given below are for the year 1983 :

Standard production cost per unit :

Component :	A	B	C	D
Variable cost .				
Direct materials	Rs. 18.50	Rs. 13.50	Rs. 12.50	Rs. 22.00
Direct wages	5.00	4.00	11.00	20.00
Direct expenses	5.00	10.00	5.00	30.00
Fixed overhead	2.50	2.00	5.50	10.00
Total production cost	31.00	29.50	34.00	82.00
Requirements in units	2,000	3,500	1,500	2,800

Direct expenses relate to the use of the metal presses which cost Rs. 5 per machine hour to operate.

Fixed overheads are absorbed as a percentage of direct wages. .

Quotations obtained from outside suppliers indicate a willingness to manufacture all or any part of the total requirement at the following prices, each delivered to the factory :

Component	Rs.
A	30.00
B	29.50
C	26.00
D	84.00

Second shift operations would increase direct wages by 25% over the normal shift and fixed overhead by Rs. 250 for each 1,000 (or part thereof) second shift hours worked.

You are required, using the information given above and showing your supporting calculations, to state :

- which component, and in what quantities, should be manufactured in the 20,000 hours of press time available ;
- whether it would be profitable to make any of the balance of components required on a second shift basis instead of buying them from outside suppliers. *(I.C.W.A. Final, June 1983)*

Suggested Approach

It is given in the question that direct expenses relate to the use of the metal presses which cost Rs. 5 per machine hour to operate. From

this information press hour per unit should be worked out. Then marginal cost per unit for each component should be compared with the prices quoted by outside suppliers and profit/loss gained by making the component is arrived at. As the limiting factor is press hours, the profit per press hour is determined. A component which yields highest profit per press hour should rank first followed by other components which yield lower profits. The normal metal capacity of 20,000 hours is the maximum capacity. From the order of ranking, the capacity of 20,000 press hours utilised for each component should be determined.

Solution :

(a) Products	A	B	C	D
Direct expenses per unit	(Rs.) 5'00	10'00	5'00	30'00
Press hours required if 1 press hour costs Rs. 5	(Hrs.) 1	2	1	6

Marginal costs :

Direct material	Rs. 18'50	Rs. 13'50	Rs. 12'50	Rs. 22'00
Direct wages	5'00	4'00	11'00	20'00
Direct expenses	5'00	10'00	5'00	30'00
Marginal cost per unit	28'50	27'50	28'50	72'00
Price per unit quoted by outside suppliers	30'00	29'50	26'00	84'00
Profit/Loss by making per unit	1'50	2'00	(2'50)	12'00
Profit per press hour	1'50	1'00	Loss	2'00
Ranking	2nd	3rd		1st

Which component and in what quantities to be manufactured in 20,000 hours of press time available.

Component (in order of ranks)

	Units	Time per press hour	Press hours
D	2,800	6	16,800
A	2,000	1	2,000
B	600*	2	1,200 (Balancing figure)
			20,000

*For component D and A full requirements will be manufactured. However, component B will be partly manufactured and partly bought out. The limiting capacity is 20,000 press hours. The press hours required for component B will be :

20,000 hours - (Total of press hours for products D and A)
 = 20,000 hours - 18,800 hours or 1,200 hours

But one unit of component B requires 2 press hours.

Thus the units manufactured = 1,200 hours ÷ 2 hours or 600 units.

(b) Whether it would be profitable to make any of the balance of components required on a second shift basis instead of buying them from outside suppliers.

Component C yields a loss of Rs. 2.50 per unit on single shift basis. So this component should be purchased from outside.

Total requirement of component B is 3,500 units. Out of which 600 units will be produced on single shift basis and the balance 2,900 components will be produced in second shift. The economics of producing 2,900 units of component B will be as under :

Profit per unit for component B	Rs. 2.00
Less : Differential cost :	
Direct Labour (Rs. 4 × 25%)	1.00
Fixed overhead (Rs. 250 for each 1,000 or part thereof second shift hours)	
$\left(\frac{\text{Rs. 250}}{1,000 \text{ hours}} \times 6,000 \text{ hrs.} \right)$ or Rs. 1,500 ÷ 2,900 =	0.52 1.52
Profit if component is produced in second shift	0.48

It is advantageous to produce 2,900 units in second shift rather than to purchase from outside.

Making a part or buy from outside resulting in spare capacity

Problem : 1996 XYZ Co. Ltd. manufactures automobile accessories and parts. The following are the total costs as also the unit costs of processing a component : SSB 1,000 :

Cost element	Total cost for 1,00,000 units	Unit cost
1. Direct material	Rs. 5,00,000	5
2. Direct labour	8,00,000	8
3. Variable factory overhead	6,00,000	6
4. Fixed factory overhead	5,00,000	5
	24,00,000	24

Another manufacturer has offered to sell the same part to XYZ Ltd. for Rs. 22 each.

The fixed overhead would continue to be incurred even when the

component is bought out although there would be a reduction to the extent to Rs. 1,50,000 following the savings in salaries of supervisory personnel that could be avoided if the company opts to 'Buy' rather than 'Make'.

(a) Should the part be made or bought considering that the present facility when released following a buying decision would remain idle ?

(b) In case the release facility can be rented to another manufacturer for Rs. 50,000, as there is a good demand for 'spare facilities', what will be the position ?
(I.C.W.A. Final, December, 1985)

Solution :

(a) and (b) Statement showing the relevant cost of Make or Buy

Details	Make	Buy at Rs. 22 per unit (present facility remains idle)	Buy the part when released facility is rented out
Variable cost of production	Rs. 19,00,000	---	---
Cost of buying from outside @ Rs. 22 p.u.	---	Rs. 22,00,000	Rs. 22,00,000
Saving in fixed cost when buying from outside	---	(1,50,000)	(1,50,000)
Rent receipts when the idle facility is rented out	---	---	(50,000)
Total relevant cost	19,00,000	20,50,000	20,00,000

The cost of making is Rs. 19,00,000 which is the lowest among other alternatives. It is, therefore, prudent to make the part rather than to purchase from outside.

Relative costs of own manufacture vs. Buy from outside

Problem 10.7. Part No. 4466 is manufactured by Modern Engineers Ltd. and is used extensively in the company's finished products. The annual requirement for this component is 12,000 units. The lowest price quotation so far required from an outside supplier is Rs. 21.50 per unit. This is being considered as the company wants to discontinue manufacture of this component and buy it from outside.

You are asked to help the company for taking a decision. In this connection, the following figures are supplied to you :

The expenses when Part No. 4466 was in production for 12,000 units were as under :

Materials	Rs. 3,50,000
Direct labour	4,00,000
Indirect labour	1,60,000
Lighting	20,000

Power	30,000
Depreciation	2,00,000
Insurance	15,000
Miscellaneous	27,000

Fringe benefits to labour work out normally 15% of total labour costs. Discontinuing the production of this component would not in any way permits the disposal of any of the factory's assets.

The following proportion of expenses can be avoided, if manufacture of Part No. 4,466 is stopped :

	Percentage
Materials	30
Direct labour	35
Indirect labour	25
Power	20

When the part is purchased from an outside supplier, shipping charges would average 75 paise per unit and indirect labour cost would be increased by Rs. 20,000 annually for receiving, inspecting and handling the purchased parts.

Prepare a schedule showing the relative costs of buying and making Part No. 4,465 and give your recommendation.

What would be the non-financial aspects that would be relevant to the decision ?
(C.A. Final, Nov., 1984)

Solution : (i) Statement showing the expenses, that can be avoided, if manufacture of Part No. 4,466 is stopped :

Materials (30% of Rs. 3,50,000)	Rs. 1,05,000
Direct labour (35% of Rs. 4,00,000)	1,40,000
Indirect labour (25% of Rs. 16,000)	40,000
Power (20% of Rs. 30,000)	6,000
Fringe benefits 15% of (Rs. 1,40,000 + Rs. 40,000)	27,000
Total	3,18,000

(ii) Statement showing the cost of buying Part No. 4466 :

Lowest price ($12,000 \times \text{Rs. } 21.50$)	Rs. 2,58,000
Shopping charges ($12,000 \times \text{Re. } 0.75$)	9,000
Additional indirect labour cost	20,000
Fringe benefits (15% of 20,000)	3,000
	2,90,000

Incremental profit on decision to buy
(Rs. 3,18,000 – Rs. 2,90,000)

28,000

Remarks : It is obvious from the analysis given above that company should buy from outside. It will result in a saving of Rs. 28,000.

For non-financial considerations, please refer to Advanced Cost and Management Accounting-Test by Saxena and Vashist.

ACCEPTING/QUOTING FOR AN ORDER OR CONTRACT

Maximum price to be quoted

Problem 10.8. *EB* and Sons build custom-made pleasure boats which range in price from Rs. 10,000 to 2,50,000. For the past 30 years. Mr. *EB* has determined the selling price of each boat by estimating the costs of materials and labour, allocating a portion of overhead based on direct labour, and adding 20% to these estimated costs.

For example, a recent price quotation was determined as follows :

Direct materials	Rs. 5,000
Direct labour	8,000
Overhead	2,000
	<hr/>
	15,000
Plus 20%	3,000
	<hr/>
Selling price	18,000
	<hr/>

If a customer rejected the price and business was slack, Mr. *EB* would often be willing to reduce his mark-up to as little as 5% over estimated costs.

Total overhead which includes selling and administrative expenses for the year has been estimated at Rs. 1,50,000 of which Rs. 90,000 is fixed and the remainder is variable varying in direct proportion to direct labour.

Assume the above customer rejected the Rs. 18,000 quotation and also rejected a Rs. 15,750 quotation (5% mark up) during a slack period. The customer countered with a Rs. 15,000 offer.

- What is the difference in net income for the year between accepting or rejecting the customer's offer ?
- What is the minimum price Mr. *EB* could have quoted without reducing or increasing net income ? (*I.C.W.A. Inter, June 1985*)

Solution :

(a) Total overhead	Rs. 1 50,000
	<hr/>
Fixed	90,000 i.e., 60% of Rs. 1,50,000
Variable	60,000 i.e., 40% of Rs. 1,50,000
	<hr/>

Marginal cost of recent quotations

Direct materials	Rs. 5,000
Direct labour	8,000
Variable overheads 40% of 2,000	800 i.e., 10% of D. labour
	<hr/>

Marginal cost	13,800
Offer by customer	15,000
Difference in net income	1,200

(b). Minimum price, that Mr. *EB* could have quoted without reducing or increasing net income is Rs. 13,800.

Minimum price at which contract to be accepted

Problem 10'9. *GTM* Ltd. consists of three departments, grinding, turning and milling, all of which have the same productive capacity. The overheads budget for the next cost period of 1,000 machine hours capacity for each department is as follows :

	Fixed costs	Direct variable cost per machine hour
Grinding	Rs. 20,000	Rs. 2'50
Turning	10,000	2'00
Milling	7,500	3'75

The Company wishes to participate in a tender in which there are three contracts *X*, *Y* and *Z*. However as per the tender terms, contracts *Y* and *Z* have to be offered as a package and *GTM* Ltd. feels that it would not offer the package unless it is profitable as contract *X*, since capacity can be utilized elsewhere.

The works manager has studied the specifications relating to these three contracts and has worked out the following details :

	Contract X	Contract Y	Contract Z
Direct Material Costs	Rs. 18,000	Rs. 16,100	Rs. 12,400
Direct Labour Costs (rate per hour) which differ due to skills involved :			

Grinding	3'0	2'5	4'5
Turning	2'0	2'5	4'0
Milling	1'5	2'0	2'25

Use of capacity (in machine hours)

Grinding	660	400	400
Turning	760	500	420
Milling	864	400	320

It will be necessary to employ 3 men in each department for the number of hours during which machine facilities are used in the work in respect of each of the three contracts.

You are required to compute :

- A comparative statement showing the minimum amount at which the firm could afford to accept the contracts
- If at least one man (included under direct labour) has to be employed in each department regardless of the level of activity, indicate the amendment to your computation in (a).

- (c) Assuming that tenders would be accepted if GTM Ltd, quoted the following prices for the contracts : X Rs. 41,000, Y Rs. 32,000 and Z Rs. 26,500, advise the firm, what he should do concerning the contracts to be accepted under the conditions (a) and (b) above. (I.C.W.A. Final, June 1983)

Solution :

(a) A Comparative Statement showing the minimum amount at which GTM Ltd. could afford to accept the contract

Contracts	X	Y	Z
Direct Material Costs	Rs. 18,000	Rs. 16,100	Rs. 12,400
Direct Labour Costs :			
Grinding	1,980	1,000	1,800
Turning	1,520	1,250	1,680
Milling	1,296	800	720
	<u>4,796</u>	<u>3,050</u>	<u>4,200</u>
× 3 men	14,388	9,150	12,600
Direct Variable Costs :			
Grinding	1,650	1,000	1,000
Turning	1,520	1,000	840
Milling	3,240	1,500	1,200
	<u>6,410</u>	<u>3,500</u>	<u>3,040</u>
Minimum amount of the contracts (marginal costs only)	<u>38,798</u>	<u>28,750</u>	<u>28,040</u>

(b) If one man (included under direct labour) has to be employed irrespective of the level of activity.

Variable cost as per (a) above	Rs. 38,798	Rs. 28,750	Rs. 28,040
Less : Wages of one worker now treated as fixed	<u>4,796</u>	<u>3,050</u>	<u>4,200</u>
Amended contract price (Marginal costs only)	34,002	25,700	23,840

(c) Recommendation regarding which contract should be accepted if the given prices are quoted.

	X	Y	Z
Price quoted	Rs. 41,000	Rs. 32,000	Rs. 26,500
Less : Variable cost as at (a) above	<u>38,798</u>	<u>28,750</u>	<u>28,040</u>
Contribution	2,202	3,250	(1,540)

As per terms and conditions of the tender, contracts Y and Z have to be offered as a package deal. Therefore, combined contribution of Y and Z is to be compared with the contribution of contract X. Whichever contract gives higher contribution, should be accepted.

Combined contribution of Y and Z Rs. 1,710

Contribution from contract X is higher than the contributions from contracts Y and Z. Therefore contract X should be accepted.

Recommendation if (b) above is accepted

	X	Y	Z
Price quoted	Rs. 41,000	Rs. 32,000	Rs. 26,500
Less : Variable cost at (b) above	34,002	25,700	23,840
Contribution	6,998	6,300	2,660
Combined contribution of Y and Z		8,960	

In this case, contracts Y and Z should be accepted.

Note. It is given in the question that overhead budget for the next costed period is prepared assuming 1,000 machine hours capacity for each department. This assumption is valid for preparation of budget only. It is presumed in solving the question that 1,000 machine hours capacity for each department is not the limiting factor.

Quotation for a tender at marginal cost

Problem 10.10. Prompt Printers Ltd, uses a scheme of pricing based on cost-plus. All the overheads are charged, based on direct labour and based on the total cost arrived at, the selling price is fixed.

The following figures are from the annual budget for 1984 prepared by the company :

Sales	Rs 10,00,000
Direct material	1,80,000
Direct labour	3,20,000
Factory Superintendent's salary	30,000
Commission paid on sales	50,000
Foremen's salaries	60,000
Insurance	10,000
Advertisement	20,000
Depreciation on assets	30,000
Administration expenses	90,000
Variable factory costs :	
Repairs and maintenance	60,000
Tools consumed	40,000
Miscellaneous supplies	10,000

The company has submitted a tender quoting Rs. 10,000 on a large order with a cost of Rs. 1,800 direct material and Rs. 3,100 direct

labour. The customer strikes the business at Rs. 8,900 on a 'take it or leave it' basis. If the company accepts the order, the total sales for 1984 would be Rs. 10,08,900. The company is reluctant to accept the order as it would be against its policy of accepting an order below cost.

As a Cost Accountant of the company, you are required to give your recommendation with supporting figures to explain that the price offered would not be below cost and a sizable profit also could be made.

(CA. Final, May 1984 Adapted)

Solution. It is given in the question that all the overhead (both fixed and variable) are charged on direct labour. Therefore, it is necessary to determine the overhead recovery rate from the data given in the annual budget for 1984. Further, profit for 1984 can be determined as under :

Direct material		Rs. 1,80,000
Direct labour		3,20,000
Variable factory costs :		
Repairs and maintenance	Rs. 60,000	
Tools consumed	40,000	
Miscellaneous supplies	10,000	
Commission (5% of sales)	50,000	
	-----	1,60,000
Fixed overhead :		
Factory supdt. salary	30,000	
Foremen's salaries	60,000	
Insurance	10,000	
Advertisement	20,000	
Depreciation on assets	30,000	
Administration expenses	90,000	
	-----	2,40,000
Total cost of sales		9,00,000
Sales		10,00,000
Profit		1,00,000
		=====

$$\text{Overhead recovery rate} = \frac{\text{Total overheads}}{\text{Direct labour}} \times 100$$

$$= \frac{\text{Rs. 4,00,000}}{\text{Rs. 3,20,000}} \times 100 \quad \text{or} \quad 125\%$$

Overhead is recovered at 125% of direct labour and profit 1/9 of total cost of sales. In the present case, the company does not distinguish between variable and fixed overhead. If budgeted pattern of overhead recovery and profit margin is adopted, the quotation will work out as under :

Direct material	Rs. 1,800
Direct labour	3,200
Overheads (125% of Rs. 3,200)	4,000
Total cost of sales	9,000
Profit (1/9 of Rs. 9,000)	1,000
Price to be quoted	10,000

From the above, following two points should be noted :

(a) the company does not differentiate between fixed overhead and variable overhead :

(b) If the above tender is accepted, the sales will go up from Rs. 10,00,000 to Rs. 10,08,900. It means this is an additional activity. Therefore, fixed overhead should be disregarded in working out the price for quotation purpose

The revised profit will be as follows :

Price offered (Incremental Revenue)	Rs. 8,900
Direct material	Rs. 1,800
Direct labour	3,200
Variable overhead (excl. sales commission)	1,100*
Commission (5% of 8,900)	445
Incremental cost	6,545
Surplus (Incremental revenue less incremental cost)	2,355

*[Variable overheads exclusive commission at sales of Rs. 10,00,000
= Rs. 1,10,000]

Variable overheads at sales of Rs. 10,000

$$= \frac{1,10,000}{10,00,000} \times 10,000 \text{ or Rs. 1,100}$$

The above computation shows that the price offered by the customer (Rs. 8,900, i.e. incremental revenue) is much more than the incremental cost (Rs. 6,545). Therefore, the company should accept the order. Normally, cost-plus basis (both fixed cost and variable cost) of pricing is most suitable basis of price quotation at normal activity level. But in the present case, acceptance of order will lead to additional sales. Thus, in such cases only marginal cost is considered.

Problem 10-11. (Evaluating a contract using replacement cost) JB Limited is a small specialist manufacturer of electronic components and much of its output is used by the makers of aircraft for both civil and military purposes. One of the few aircraft manufacturers has offered a contract to JB Limited for the supply, over the next twelve months, of 400 identical components. The data relating to the production of each component is as follows :

(i) **Material requirements :**

3 kilogrammes material M₁—see note 1 below

2 kilogrammes material P_2 —see note 2 below

1 Part No. 678 —see note 3 below

Note 1. Material M_1 is in continuous use by the company, 1,000 kilogrammes are currently held in stock at a book value of Rs. 4.70 per kilogramme but it is known that future purchases will cost Rs. 5.50 per kilogramme.

Note 2. 1,200 kilogrammes of material P_2 are held in stock. The original cost of this material was Rs. 4.30 per kilogramme but as the material has not been required for the last two years it has been written down to Rs. 1.50 per kilogramme scrap value. The only foreseeable alternative use is as a substitute for material P_4 (in current use) but this would involve further processing costs of Rs. 1.60 per kilogramme. The current cost of material P_4 is Rs. 3.60 per kilogramme.

Note 3. It is estimated that the Part No. 678 could be bought for Rs. 50 each.

(ii) **Labour requirements.** Each component would require five hours of skilled labour and five hours of semi-skilled labour. An employee possessing the necessary skills is available and is currently paid Rs. 5 per hour. A replacement would, however, to be obtained at a rate of Rs. 4 per hour for the work which would otherwise be done by the skilled employee. The current rate for semi-skilled work is Rs. 3 per hour and an additional employee could be appointed for this work.

(iii) **Overhead.** JB Limited absorbs overhead by a machine hour rate, currently Rs. 20 per hour of which Rs. 7 is for variable overhead and Rs. 13 for fixed overhead. If this contract is undertaken, it is estimated that fixed costs will increase for the duration of the contract by Rs. 3,200. Spare machine capacity is available and each component would require four machine hours.

A price of Rs. 145 per component has been suggested by the large company which makes aircraft.

You are required to : (a) state whether or not the contract should be accepted and support your conclusion with appropriate figures for presentation to management ;

(b) comment briefly on three factors which management ought to consider and which may influence their decision.

(C.J.M.A. London. May 1987)

Solution. (a) Proposed Contract Cost

Details	Unit Cost	Alternative total Cost Presentation
Materials :		
3 kgs. M_1 at replacement cost Rs. 5.50	Rs. 16.50	Ra. 6,600
2 kgs. M_2 at replacement cost, i.e., Rs. 3.60	7.20	

Less : Further processing cost of currently held P₂
(2 × Rs. 1'60)

3'20*	4'00	1,600
	20'50	8,200
	50'00	20,000
	70'50	28,200

Part No. 678

Labour :

5 hours skilled at replacement cost of Rs. 4'00	20'00	8,000
5 hours semi-skilled at Rs. 3'00	15'00	6,000
		14,000
Variable overhead (Rs. 4 × 7 Hrs)	28'00	11,200

Total Variable Cost 133'50 53,400

*Readers may please note how opportunity cost of M₂ has been found.

Add : Incremental Fixed Costs
(Rs. 3,200 ÷ 400 units)

8'00 3,200

Total Incremental (out of pocket) Cost
Profit

141'50 56,600
3'50 1,400

Selling Price

145'00 58,000

Conclusion. Contract should be undertaken as the price offered is more than incremental cost. In no circumstances, the work should be undertaken at a price less than Rs. 141'50.

(b) (i) Probability of repeat order

(ii) Accepting the contract will provide employment for a considerable period and would utilize the facilities.

(iii) Some current stocks are getting utilized. It should be noted that replacement costs for materials and even wages have been used. If book values had been used, profit would have been higher.

Problem 10'12. Shri Kiran manufactures lighters. He sells his product at Rs. 20 each, and makes profit of Rs. 5 on each lighter.

He worked 50 per cent of his machinery capacity at 50,000 lighters. The cost of each lighter is as under :

Direct material	Rs. 6
Wages	2
Works overhead	5 (50 per cent fixed)
Sales expenses	2 (25 per cent variable)

His anticipation for the next year is that the cost will go up as under :

$$\begin{array}{ll}
 x = \text{Rs. } 4,95,000 \times 25/15 & \text{or Rs. } 8,25,000 \\
 y = \text{Rs. } 3,75,000 \times 25/15 & \text{or Rs. } 6,25,000
 \end{array}$$

Fixed charges	10%
Direct labour	20%
Material	5%

There will not be any change in selling price.

There is an additional order for 20,000 lighters in the next year.

What is the lowest rate he can quote so that he can earn the same profit as the current year ?
(C.A. Final. November, 1984)

Solution :

Statement showing cost and profit for current year for 50,000 lighters

	Per unit Rs. 20'00	For 50,000 lighters Rs. 10,00,000
Sales		
Material	Rs. 6'00	Rs. 3,00,000
Wages	2'00	1,00,000
Works overhead	2'50	1,25,000
Sales expenses	0'50	25,000
Marginal cost	11'00	5,50,000
Contribution	9'00	4,50,000
Less : Fixed cost (Rs. 1,25,000 + Rs. 75,000)		2,00,000
* Profit		2,50,000

Anticipated variable cost per unit :	Material	= Rs. 6'30.. (After 5% increase)
	Labour	= 2'40... (" 20% increase)
	Work Overheads	= 2'50.. (" No increase)
	Sales Exp.	= 0'50... (" No increase)

Anticipated marginal cost 11'70

Anticipated contribution per unit 8'30

Price (No change) 20'00

Anticipated fixed cost next year = Rs. 2,20,000 ... (10% increase)

Contribution required for next year = Fixed cost + Present profit

= Rs. 2,20,000 + 2,50,000 = Rs. 4,70,000

Contribution on 50,000 units

= 50,000 × 8'30 = Rs. 4,15,000

Contribution required to be made on 20,000 units

55,000

Additional contribution per unit	=Rs. 55,000÷20,000 units
	=Rs. 2.75 per unit
Lowest rate to be quoted	=Rs. 11.70 variable cost + Rs. 2.75 contribution = Rs. 14.45

**Quotation for an order (incremental units) at no-profit no-loss—
Unutilized capacity**

Problem 10.13. Forward Foundry Ltd., is feeling the effects of a general recession in the industry. Its budget for the coming half year is based on an output of only 500 tonnes of casting a months which is less than half of its capacity. The prices of castings vary with the composition of the metal and the shape of the mould, but they average Rs. 175 a tonne. The following details are from the Monthly Production Cost Budget at 500-tonne level :

	Core making	Melting and pouring	Moulding	Cleaning and grinding
Labour	Rs. 10,000	Rs. 16,000	Rs. 6,000	Rs. 4,500
Variable overhead	3,000	1,000	1,000	1,000
Fixed overhead	5,000	9,000	2,000	1,000
	<u>18,000</u>	<u>26,000</u>	<u>9,000</u>	<u>6,500</u>
Labour and overhead per direct hour	<u>9.00</u>	<u>6.50</u>	<u>6.00</u>	<u>5.20</u>

Operation at this level has brought the company to the brink of break-even. It is feared that if the lack of work continues, the company may have to lay off some of the most highly skilled workers whom it would be difficult to get back when the volume picks up later on. No wonder, the Works Manager at this juncture, welcome an order for 90,000 castings, each weighing about 40 lbs., to be delivered on a regular schedule during the next six months. As the immediate concern of the Works Manager is to keep his work force occupied, he does not want to lose the order and is ready to recommend a quotation on a no-profit and no-loss basis.

Materials required would cost Re. 1 per casting after deducting scrap credits. The direct labour hours per casting required for each department would be :

Core making	0.09
Melting and pouring	0.15
Moulding	0.06
Cleaning and grinding	0.06

Variable overheads would bear a normal relationship to labour cost in the melting and pouring department and in the moulding department. In core making, cleaning and grinding, however, the extra labour require-

ments would not be accompanied by proportionate increases in variable overhead. Variable overhead would increase by Rs. 1.20 for every additional labour hour in core making and by 30 paise for every additional labour hour in cleaning and grinding. Standard wage rates are in operation in each department and no labour variances are anticipated.

To handle an order as large as this, certain increases in factory overheads would be necessary amounting to Rs. 1,000 a month for all departments put together. Production for this order would be spread evenly over the six months period.

You are required to :

(a) Prepare a revised monthly labour and overhead Cost Budget, reflecting the addition of this order.

(b) Determine the lowest price at which quotation can be given for 90,000 castings without incurring a loss. (C.A. Final, Nov.1983)

Solution : Calculation of required Cost Details

	Core making	Melting and pouring	Moulding	Cleaning and grinding
(i) Labour and overhead (Given)	Rs. 18,000	Rs. 26,000	Rs. 9,000	Rs. 6,500
(ii) Labour and overhead per direct labour hour (Given)	9.00	6.50	6.00	5.20
(iii) Labour hours in different departments (i) ÷ (ii)	2,000 hrs.	4,000 hrs.	1,500 hrs.	1,250 hrs.
(iv) Labour rate per hour	$\frac{18,000}{2,000}$	$\frac{26,000}{4,000}$	$\frac{9,000}{1,500}$	$\frac{6,500}{1,250}$
(ii) ÷ (iii)	or Rs. 9	or Rs. 6.50	or Rs. 4	or Rs. 4.16
(v) Variable overhead rate per hour before accepting order	$\frac{3,000}{2,000}$ or Rs. 1.50	$\frac{1,000}{4,000}$ or Re. 0.25	$\frac{1,000}{1,500}$ or Re. 0.67	$\frac{1,000}{1,250}$ or Re. 0.8
(vi) Requirement in hours for additional order for 10,000 casting per month, i.e., (90,000 castings ÷ 6 months)	$10,000 \times 0.09$ or 1,350 hrs.	$15,000 \times 0.15$ or 2,250 hrs.	$10,000 \times 0.06$ or 900 hrs.	$11,000 \times 0.06$ or 900 hrs.
(vii) Labour rate per hour	Rs. 9	Rs. 6.50	Rs. 4	Rs. 4.16
(viii) Labour cost for additional order	$1,350 \times 9$ or Rs. 12,150	$2,250 \times 6.50$ or Rs. 14,625	900×4 or Rs. 3,600	900×4.16 or Rs. 3,744

(ix) Variable cost for additional order $1,350 \times 1.20 \text{ hrs.} \times \frac{1,000}{16,000} \times 9,000 \times \frac{1,000}{6,000} \times 3,600 \times 0.3$
 or Rs. 1,620 or Rs. 563 or Rs. 600 or Rs. 270

Statement showing labour and overheads:

(a) Cost budget after accepting an order of 90,000 castings

Departments	Core Making	Melting and Pouring	Moulding	Cleaning and Grinding	Total
Labour :					
For existing 500 tonnes	10,000	16,000	6,000	4,500	
For additional order (Refer to viii)	6,750	9,000	3,600	3,240	
Total	<u>16,750</u>	<u>25,000</u>	<u>9,600</u>	<u>7,740</u>	59,090
Variable overhead :					
For existing 500 tonnes	3,000	1,000	1,000	1,000	
For additional order (Refer to (ix))	1,620	563	600	270	
Total variable cost	<u>4,620</u>	<u>1,563</u>	<u>1,600</u>	<u>1,270</u>	9,053
Fixed overhead	<u>5,000</u>	<u>9,000</u>	<u>2,000</u>	<u>1,000</u>	17,000
Total	<u>26,370</u>	<u>35,563</u>	<u>13,200</u>	<u>10,010</u>	85,143
Increase in factory overhead					<u>1,000</u>
Total labour and overhead cost					<u>86,143</u>

(b) Lowest price to be quoted for 90,000 castings

Material cost :	Ra.
15,000 castings @ Rs. 1 each	15,000
Labour and overhead cost :	Ra.
Revised Budget	86,143
Current Budget	59,500
(18,000 + 26,000 + 9,000 + 6,500)	<u>26,643</u>
Total Incremental cost for 15,000 castings	<u>41,643</u>

Lowest price without incurring loss $(41,643 \div 15,000) \times 90,000$
 or Rs. 2,49,858

EXPAND OR CONTRACT**Financial implications of totally discontinue production or partly discontinue**

Problem 10-14 Elec. Ltd. is engaged in the manufacture of four products in its factory. The production and sales volume is much lower than the normal volume and so there is substantial unfavourable variance in the recovery of overheads. The sales and cost data for a year are as under :

	<i>Products (Rs. in lacs)</i>				<i>Total</i>
	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	
Sales	400	500	200	100	1,200
Direct material	64	70	32	7	173
Direct wages	88	105	60	18	271
Factory overheads	128	172	120	24	444
Selling and administration overheads	80	100	40	20	240
Total costs	360	447	252	69	1,128
Profit/loss	40	53	-52	31	72
Unabsorbed overheads					48
Net profit					24

50 per cent of the factory overhead is variable at normal operating volume and the variable selling and administration overhead account for 5% of sales.

Of the total sales of product 'C' half of the volume is used in the market for applications in which product 'D' can be substituted. Thus, if product C is not available the sale of product 'D' can be increased by Rs. 100 lacs without any change in fixed selling expenses.

Of the total sales of product 'C' about 25% is sold in conjunction with product 'A'. The customers will not be able to substitute product 'D' and so the sales of product 'A' will be reduced by 12.5% of the present level if product 'C' is withdrawn.

In the event of total discontinuance of product 'C' the fixed factory and selling and administration overheads will be reduced by Rs. 20 lacs. Alternatively, if the production and sales of product 'C' is maintained to the extent of 25% of the present level as service to product 'A', there will be a reduction in the fixed costs to the extent of Rs. 10 lacs.

You are required to :

- (a) Prepare statements to show the financial position of :
 - (i) Continuance of product C.
 - (ii) Total discontinuance of product C.
 - (iii) Continuance of product 'C' only as service to customers using product 'A' whose business will otherwise be lost.

(b) Make your recommendations on the course of action to be taken by the company with such comments as you may like to offer.

(C.A. Final, May 1985)

Solution : Computation of total Fixed overhead

(Rs. in lacs)

Factory overheads	444	
Less : Variable overhead (50% of this factory)	222	

Balance is fixed overhead		222
Selling and administration overhead	240	
Less : Variable selling and administration overhead (5% of sales)	60	

Balance is fixed selling and administration overhead		180
Unabsorbed overheads		48

		450

(a) (i) Statement showing financial implication of continuance of product 'C'

(Rs. in lacs)

	Products				Total
	A	B	C	D	
Sales	400	500	200	100	1,200
Direct materials	64	70	32	7	173
Direct wages	88	105	60	18	271
Variable factory overhead	64	86	60	12	222
Variable selling and administration overhead (5% of sales)	20	25	10	5	60
Total variable cost	236	286	162	42	726
Contribution	164	214	38	58	474
Fixed overheads					450
Profit					24

**(a) (ii) Statement showing financial implication of
total discontinuance of product C**

(Rs. in lacs)

	<i>Products</i>			<i>Total</i>
	<i>A</i>	<i>B</i>	<i>D</i>	
Sales	*350	500	200	1,050
Direct material	56	70	14	140
Direct wages	77	105	36	218
Factory overhead	56	86	24	166
Selling and administration overhead	17.5	25	10	52.5
Total variable overhead	206.5	286	84	576.5
Contribution	143.5	214	116	473.5
Less : Fixed overhead				430.0
Profit				43.5

Working Notes for (a) (ii)

*Sale of product 'A' will be reduced by 12.5% of the present level if product 'C' is withdrawn. Therefore sale of product A will be Rs. 350 lacs i.e., $400 \times 87.5 \div 100$.

@It is given in question that sales of product 'D' can be increased by Rs. 100 lacs without any change in the fixed selling expenses. Therefore, sales of product D will be Rs. 200 lacs and variable cost will also increase accordingly.

It is given in question that in the event of total discontinuance of product 'C', the fixed factory and selling and administration overhead will be reduced by Rs. 20 lacs. Therefore total fixed overhead after discontinuance of product 'C' will be Rs. 430 lacs, i.e., Rs. 450 lacs—Rs. 20 lacs.

**(a) (iii) Statement showing financial implication of continuance
of product 'C' only as service to customers using
product 'A' whose business will otherwise be lost**

(Rs. in lacs)

	<i>Products</i>				
	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	
Sales	400	500	50*	200	1,150

Direct material	64	70	8	14	156
Direct wages	88	105	15	36	244
Variable factory overhead	64	86	15	24	189
Variable selling and administration overhead	20	25	2.5	10	57.5
	<u>236</u>	<u>286</u>	<u>40.5</u>	<u>84</u>	<u>646.5</u>
Contribution	164	214	9.5	116	503.5
Fixed overhead					@ 440.0
Profit					<u>63.5</u>

Working Notes for a (iii)

*It is given in question that of the total sales of product 'C' about 25% is sold in conjunction with product 'A'. Since in this alternative continuance of product 'C' only as service to customers using product 'A' is being considered, the sales of product C will be 25% of Rs. 100 lacs, i.e., Rs. 50 lacs.

@It is given that, if the production and sales of product 'C' is maintained to the extent of 25% of the present level as service to product 'A', there will be a reduction in the fixed costs to the extent of Rs. 10 lacs. Therefore, in this case fixed overhead will be Rs. 450 lacs, i.e., Rs. 450 - Rs. 10 lacs.

(b) The above analysis indicates that alternative (a) (iii) is most profitable. It leads to the profit of Rs. 63.5 lacs which is maximum. The reason for this is that third alternative emphasises the production of D, which yields the highest contribution. Thus, company is advised to adopt the third alternative, i.e., continuance of product C as service to product A.

Problem 10-15 (Accepting an Order) Standease Corporation are currently selling 5,000 units of their product per month, which is only 40% of the normal productive capacity of the plant of the company. The selling price of Rs. 12.50 per unit of their product does not give them any profit.

An analysis of the costs of the company for the month of June during which only 4,000 units were produced and 5,000 sold, shows the following :

	Rs.
Direct Labour	9,600
Superintendent's Salary	4,000
Asstt. Superintendent's Salary	2,500
Power	800
Direct Materials	4,000
Purchased Components	2,400
Depreciation of Building	1,500
Maintenance of Building	300
Electricity Charges	248
Indirect Labour	<u>2,000</u>

Maintenance Supplies	800
Depreciation of Machinery	2,640
Repairs to Machinery	500
Sales Manager's Salary	4,000
Salesmen's Commission	19,000
Travelling Apportioned	252
Packing and Forwarding	2,500
Bad Debts	625
Advertising	500
General Administration	5,835
	<hr/>
	64,000
	<hr/>

Marchon Ltd. had offered to buy 5,000 units of this product per month from Standatease Corporation. The modification that is required is very insignificant and the unit will be used as a component part in the manufacture of Marchon Ltd. The price offered is Rs. 10 per unit and the company is ready to enter into a one year contract. The management of Standatease Ltd. does not expect that there will be an improvement in the business within next year and there is no fear that the sale of the units to Marchon Ltd. would reduce the present volume of sales to consumers, as the units are going to be used by Marchon Ltd. only as component parts in their manufacture. But the management of Standatease Corporation are very reluctant to accept the order as they are losing at the present price of Rs. 12.50 and the order if accepted will only increase the losses.

You are required to prepare an 'analysis of costs to demonstrate that the order can be accepted. All items of cost are either completely fixed or completely variable except the following :

Power	80% Variable
Indirect Labour	40% Fixed
Maintenance Supplies	50% Fixed
Repairs to Machinery	20% Fixed.

Solution :

(C.A. Final, November 1987)

Note. Three points should be kept in mind :

(i) The production is 4,000 units. Therefore factory costs given are for 4,000 units.

(ii) The selling costs are for 5,000 units.

(iii) The analysis is required to determine, whether the order should be accepted. Therefore only relevant cost will form part of analysis. If the sale per unit yields contribution, order should be accepted.

**Statement showing analysis of cost to determine
whether order should be accepted.**

<i>Variable Factory Costs :</i>	<i>Total</i>	<i>Per Unit</i>
(on the basis of 4,000 units)	Rs.	Rs.
Direct Material	4,000	1'00
Direct Labour	9,600	2'40
Purchased Component	2,400	0'60
Power (80% variable)	640	0'16
Indirect Labour (60% variable)	1,200	0'30
Maintenance Supplies (50% variable)	400	0'10
Repairs to machinery (80% variable)	400	0'10
	<u>18,640</u>	<u>4'66</u>
 <i>Variable Selling Costs :</i>		
(on the basis of 5,000 units)		
Salesmen's Commission	Rs. 19,000*	Rs. 3'80
Packing and Forwarding	2,500	0'50
Bad Debt	625**	0'125
	<u>22,125</u>	<u>4'425</u>
 Total cost per unit		<u>9'085</u>
 Contribution per unit		<u>0'915</u>
 Selling price per unit		<u>10'000</u>

Since there is a contribution of Re. 0'915 per unit, order should be accepted to utilize the capacity as far as possible.

*It is assumed to be variable.

**Normally bad debt should not form part of cost, but it is written in the question that all items of cost are either completely fixed or completely variable except the specified ones.

ACCEPTING OR REJECTING AN EXPORT ORDER

Incremental Analysis for exports — Unutilized capacity

Problem 10-16. Texomat Private Limited has been manufacturing track suits for athletes. Currently its output is around 70 per cent of its rated capacity of 19,000 units per annum. One exporter has approved the sample and has offered to buy 5,000 units at a special price of Rs. 150 per suit. At present, the Company has been selling the track suit @ Rs. 210. The standard cost per unit is as under :

(i) Cloth and other materials	Rs. 82
(ii) Labour	25
(iii) Fixed cost	42
(iv) Administration, variable cost	11
 Total cost	<u>160</u>

(a) Should the Company accept the offer ?

(b) What would be your advice if the exporter offers to buy 10,000 units instead of 5,000 units ?

Note : Please write your answer in a sequential manner. Mere mechanical approach will entail loss of marks.

(C.S. Final, June 1984)

Solution : (a) Present rated capacity (units)=	19,000
Capacity utilized (70%)	13,300
	<hr/>
Spare capacity available	5,700
	<hr/>

Incremental revenue on export offer (5,000 units × Rs. 150)	Rs. 7,50,000
Less : Differential cost (Rs. 82+25+11=118) (5,000 × 118)	5,90,000
	<hr/>
Incremental profit	1,60,000
	<hr/>

Note : Fixed cost need not be considered for export offer as the same has to be borne by indigenous production. This offer gives a profit of Rs. 1,60,000 and, therefore, the same should be accepted.

(b) Profitability if export offer of 10,000 units is accepted

For exports	10,000 units
For indigenous production (Balance)	9,000
	<hr/>
Rated capacity	19,000
	<hr/>
Incremental Revenue or Exports (10,000 × Rs. 150)	Rs. 15,00,000
Less : Differential cost (10,000 × 118)	11,80,000
	<hr/>
Incremental profit	3,20,000
Less : Profit forgone on indigenous production 4,300 i.e., (13,300--9,000) @ Rs. 92*	3,95,600
	<hr/>
Loss	75,600

This offer should not be accepted as it will result in net loss of Rs. 75,600.

*Indigenous price Rs. 210--Export price Rs. 118=Rs. 92.

Overseas vs. Domestic Sales

Problem 10-17. A company currently operating at 80% capacity has the following profitability particulars :

Sales		Rs. 12,80,000
Costs :		
Direct materials	Rs. 4,00,000	
Direct labour	1,60,000	
Variable overheads	80,000	
Fixed overhead	5,20,000	11,60,000
	<hr/>	<hr/>
Profit		1,20,000
		<hr/>

An export order has been received that would utilize half the capacity of the factory. The order has either to be taken in full and executed at 10% below the normal domestic prices, or rejected totally. The alternatives available to management are given below :

- (i) Reject the order and continue with the domestic sales only, as at present ;
- (ii) Accept order, split capacity equally between overseas and domestic sales and turn away excess domestic demand.
- (iii) Increase capacity so as to accept the export order and maintain the present domestic sales by :
 - (a) buying an equipment that will increase capacity by 10% and fixed cost by Rs. 40,000, and
 - (b) work overtime at time and a half to meet balance of required capacity.

Prepare comparative statements of profitability and suggest the best alternative. (I.C.W.A. Final, June 1983)

Solution :

(i) Sales			Rs. 12,80,000
Less : Variable costs :			
Direct materials	Rs. 4,00,000		
Direct labour	1,60,000		
Variable overhead	80,000		6,40,000
Contribution			6,40,000
Less : Fixed overhead			5,20,000
Profit			1,20,000
P/V ratio (Contribution/Sales)			50%
(ii) Sales at 80% capacity			12,80,000
Sales at 100% capacity			16,00,000
Export Sales :			Rs.
50% of capacity of factory			8,00,000
Less : 10% due to price reduction			80,000
			7,20,000
Add : Domestic sales by utilizing 50% of balance capacity			8,00,000
Total sale for utilizing 100% capacity under alternative (ii)			15,20,000
Less : Variable cost :			
(6,40,000 ÷ 80%)			8,00,000

Contribution		7,20,000
Less : Fixed cost		5,20,000
Profit		2,00,000
(iii) Sales :		Rs.
Domestic sales		12,80,000
Export sales		7,20,000
		20,00,000
Less : Marginal cost :	Rs.	
(a) For domestic sales (as given in alternative (i))	6,40,000	
(b) For overtime paid for meeting balance of required capacity, i.e., 20% capacity (Refer to working note)	20,000	
(c) For Exports Sales	4,00,000	
$\left(\frac{6,40,000}{80\%} \times 50\% \right)$		10,60,000
Contribution under alternative (iii)		9,40,000
Less : Fixed Cost :		
(i) Existing	5,20,000	
(ii) Increase in fixed cost to meet 10% increase in capacity	40,000	5,60,000
Profit		3,80,000

Alternative (iii) yields the highest profit. Hence, it is the best alternative

Working Notes :

Calculation of Overtime

Capacity required for Exports order is 50%.

Capacity presently being used is 80%.

∴ Increase required in capacity is 30%. This is met as follows :

(a) Working full capacity	100%
(b) Buying new equipment	10%
(c) Working overtime	20%
	130%

∴ Direct labour for 80% capacity (Given) = Rs. 1,60,000

∴ Direct labour for 20% capacity (Given) = 40,000

Overtime Premium is half of it = 20,000

Lowest price to be quoted for export order

Problem 10-18. The operating particulars of a manufacturing company for 1982-83 were as under :

	%
Direct materials	40
Direct wages	20
Variable factory overhead	10
Variable selling and Administration overheads	5
Fixed costs	20
Profit	5
	<hr/>
Selling price	100
	<hr/>

During the year 1983-84 the company anticipated an increase of 2½%, 5% and 10% respectively in direct material, direct wages and factory variable overhead costs. The sales volume, however, was estimated to be Rs. 320 lakhs being equivalent to 80% of the achievement of 1982-83.

After the budget for 1983-84 had been set, the company required a proposal for an export order for the utilization of its idle capacity as under :

- (a) the prime cost of the export order is Rs. 31 lakhs.
- (b) Special export expenses on the whole export order is Rs. 1,00,000.
- (c) An export incentive of 5% on the export price is available on the export order. Required :
- (i) Present a budget for 1983-84 showing the profitability or otherwise on home sales.
- (ii) Establish a suitable method for recovery of overheads and find the lowest price to be quoted on the export order.

(I.C.W.A. Final, June 1984)

Solution : (i) **Operating results of 1982-83**

	<i>Rs. in lakhs</i>	%
Direct material	160	40
Direct wages	80	20
Variable factory overheads	40	10
Variable selling and administration overheads	20	5
Fixed costs	80	20
Profit	20	5
	<hr/>	<hr/>
Selling price	400	100
	<hr/>	<hr/>

(ii) Budgeted for 1983-84 based on home sales)

	1982-83	Increase	1983-84	Rs. in lakh 1983-84	
			%	100%	(80% level)
	to last year figure				
Direct material	40	2.5	41	164	131.20
Direct wages	20	5	21	84	67.20
Variable factory overheads	10	10	11	44	35.20
Variable selling and administration overheads	5		5	20	16.00
Fixed cost	20		20	80	80.00
Profit	5		2	8	(9.60)
	100		100	400	320

(iii) Prime cost of export order is Rs. 31 lakhs

The break up will be :	%	Rs. in lakhs
Direct material	41	20.50
Direct wages	21	10.50
	62	31.00

The cost break up will be as follows :	%	Rs. in lakhs
Direct material	41	20.50
Direct wage	21	10.50
Variable overhead	11	5.50
Selling and administration	5	2.50
		39.00
Special export		1.00
Total variable cost		40.00

Export incentive is 5% on export price.

∴ Minimum price to be quoted for export
 $= 40 \div 105 \times 100$ or Rs. 38.10 lakhs.

Acceptance of overseas order

Problem 10-19. Nubo Manufacturing Company is presently operating at 50% of practical capacity producing about 50,000 units annually of a patented electronic component. Nubo recently received an offer from overseas market to sell 30,000 components at Rs 6.00 per unit, F.O.B. Nubo's plant. Nubo has not previously sold components in this market. Budgeted production costs for 50,000 and 80,000 units of output are as follows :

Units	50,000	80,000
Costs :		
Direct material	Rs. 75,000	Rs. 1,20,000
Direct labour	75,000	1,20,000
Factory overhead	2,00,000	2,60,000
	<u>3,50,000</u>	<u>5,00,000</u>
Cost per unit (Rs.)	7'00	6'25

The sales manager thinks the order should be accepted, even if it results in a loss of Re. 1'00 per unit, because he feels that sales may build up future markets. The production manager does not wish to have the order accepted primarily because the order would show a loss of Re. 0'25 per unit when computed on the new average unit cost. The cost accountant has made a quick computation indicating that accepting the order will actually increase profit.

You are required to :

- Explain what apparently caused the drop in cost from Rs. 7'00 per unit to Rs. 6'25 per unit when budgeted production increased from 50,000 to 80,000 units. Show supporting computations.
- Should the order be accepted. *(I.C.W.A. Inter., June 1983)*

Solution :

The company is at present operating at 50% of practical capacity producing about 50,000 units per annum. If export order is accepted, the production will go up to 80,000 units per annum. Here it is required to explain the reason for reduction of unit cost from Rs. 7'00 to Rs. 6'25. For this reason, it is necessary to arrive at the unit cost at 50,000 units and 80,000 units.

**Statement showing Total Cost and Cost per unit
at Two—Capacity Level**

Production (units)	50,000		80,000	
Details	Total cost	Cost per unit	Total cost	Cost per unit
Costs :	Rs.	Rs.	Rs.	Rs.
Direct material	75,000	1'50	1,20,000	1'50
Direct labour	75,000	1'50	1,20,000	1'50
Prime cost	<u>1,50,000</u>	<u>3'00</u>	<u>2,40,000</u>	<u>3'00</u>
Factory overhead	2,00,000	4'00	2,60,000	3'25
Total factory cost	<u>3,50,000</u>	<u>7'00</u>	<u>5,00,000</u>	<u>6'25</u>

Up to prime cost, there is no difference in cost per unit at two production levels. But difference in unit cost is due to factory overheads which are of semi-variable nature. First of all, semi-variable factory overheads may be segregated into fixed overhead and variable overhead.

Change in levels of two production capacities	80%	50%	Change
(Units)	80,000	50,000	30,000
Change in factory overhead (Rs.)	2,60,000	2,00,000	60,000

Variable cost per unit = $\frac{\text{Change in factory overhead at two levels}}{\text{Change in output at two levels}}$

$$= \frac{\text{Rs. } 60,000}{30,000 \text{ units}} \text{ or Rs. } 2.00 \text{ per unit}$$

Fixed factory overhead will be as follows :	50%	80%
Total factory cost at two levels	Rs. 2,00,000	Rs. 2,60,000
Less : Variable cost (50,000 × 2)	1,00,000	
(80,000 × 2)		1,60,000
Fixed overhead	1,00,000	1,00,000

Impact of fixed overhead per unit :

$$\begin{array}{rcl} 1,00,000 \div 50,000 & 2.00 & \\ 1,00,000 \div 80,000 & & 1.25 \end{array}$$

Therefore, factory overhead has come down by Re. 0.75, when the production is increased to 80,000 units from 50,000 units.

(b) If order is accepted, the cost, contribution and loss will be as under :

	At 80,000 production level per unit	
Sales realisation on exports	6.00	
Less : Variable cost :		
Prime cost	3.00	
Add : Variable portion of factory overhead	2.00	5.00
Contribution		1.00
Less : Fixed overhead		1.25
Loss		0.25

The calculation made by cost accountant is correct. The order should be accepted as this loss will be compensated by export subsidies to be received at a later date.

Minimum price to be quoted for export order—Surplus capacity

Problem 10.20. Vacuum Tubes Ltd., is producing 5,000 tubes per annum. Each tube is sold at Rs. 1,600 per unit and has variable cost of

Rs. 1,550. Annual fixed cost burden of the company is Rs. 3 lacs. Present capacity is used up to 60%.

The unit has received an enquiry from a foreign buyer for 2,500 T.V. tubes. The management wants your advice regarding the minimum price that can be quoted to the foreign buyer so that capacity utilization is increased and loss is avoided.

Following additional information has been supplied to you by management. The export business will fetch following additional benefits which have to be considered in calculating the quotation of F.O.B. price.

(a) 10% cash assistance on F.O.B. price realisation as an incentive from Government.

(b) The excise duty content in the inputs will be refunded by way of duty drawback by Government. This will be 5% of F.O.B.

(c) Government will issue an import licence up to 10% of F.O.B. realisation. The import licence can be sold in market at a premium of 100%. The licence can also be used for importing Printed Circuit Boards which can be sold at 20% profit on cost price.

Please advise the bare minimum F.O.B. price for the T.V. tube to break even, if :

(a) The import licence is sold in market.

(b) The import licence is used for importing Printed Circuit Boards.
(I.C.W.A. Final, December 1985)

Solution : Statement showing present loss

Selling price per T.V. tube	Rs. 1,600
Less : Variable cost per tube	Rs. 1,550

Contribution per tube	50

Contribution on 5,000 tubes	Rs. 2,50,000
Less : Fixed cost	Rs. 3,00,000

Present loss	50,000

This loss has to be covered by import business, i.e., 2,000 T.V. tubes.
∴ each tube should bear $\text{Rs. } 50,000 \div 2,500 = \text{Rs. } 20$ per tube.

(a) If import licence is sold in the market

Cost per T.V.	Rs. 1,550
Profit required	20

Price without export benefits	1,570

Less : 10% on FOB price for cash assistance
 5% on FOB price for duty drawback
 10% on FOB price for premium on import licence

25%

If FOB without export benefit is Rs. 125 export price will be
 = Rs. 100

If FOB without export benefit is Rs. 1,570 export price will be
 = $\frac{\text{Rs. 100}}{\text{Rs. 125}} \times \text{Rs. 1,570} = \text{Rs. 1,256.}$

(b) If import licence is used for using Printed Circuit Boards

FOB price without export benefits = Rs. 1,570

Less : Export benefits :

10% Cash assistance
 5% Duty drawback
 2% (i.e., 20% of 10%) profit on Printed Circuit Board

 17%

Minimum FOB = $\frac{1,570}{\text{Rs. 117}} \times \text{Rs. 100}$ or Rs. 1341'88

Check :

	<i>Licence sold</i>	<i>Licence used</i>
FOB price as above	Rs. 1,256'00	Rs. 1,341'88
Add : Duty drawback 5%		
Cash assistance 10%		
15%	Rs. 188 40	Rs. 201'28
Premium 10%	Rs. 125 60	—
Profit on PCB 20% of 134'19		26'84
It is the price which gives desired profit of Rs. 20 per unit	1,570'00	1,570'00

Incremental approach for export order

Problem 10-21. The following data is extracted from the budget documents of Rao Ltd., which pertains to the calendar year 1984 :

Capacity utilisation	60%	70%	80%	90%	100%	Between 101 and 120%
Factory expenses	Rs. 45,000	45,000	50,000	50,000	60,000	70,000
Fixed factory costs	Rs. 60,000	60,000	60,000	60,000	65,000	65,000
Office overheads	Rs. 40,000	40,000	40,000	40,000	40,000	40,000

Installed capacity of the plant—10,000 tonnes per annum which could be expanded up to a margin of 20% by incurring additional expenses of Rs. 10,000.

Selling and distribution costs including commission to distributors account for 10 per cent of the sales value.

Up to April 1984, the Company has been able to market completely its production fully locally at a unit realisation value of Rs. 80 per tonne. Monthly production of 750 tonnes is expected to be maintained throughout the year which will satisfy the local market. The Company will be able to maintain its sale price locally. Direct labour, direct material and direct overheads account for 60 per cent of the price of the product.

The Company has received an enquiry from abroad for manufacture and supply of 3,000 tonnes at US \$ 6 per tonne, *c.i.f.* commission payable to a foreign agent will be 50 cents per tonne and insurance and freight charges are estimated at 50 cent per tonne. The export order will fetch the Company an export incentive licence for 20 per cent of the quantum of exports. The current market value of the licence, which can be transferred freely, is Rs. 60 per tonne.

Kindly indicate whether the export order can be accepted by the Company.

Workings are to form part of your answer.

Assume 1 US Dollar is equivalent to Rs. 10. (C.A. Final, May 1984)

Solution : Budgeted contribution and net profit during 1984

Installed capacity p.a.	= 10,000 tonne
Actual production during the year (750 × 12)	= 9,000 tonne
Capacity utilization	= 90%
Selling price per tonne	= Rs. 80
Less : Variable costs :	
Direct material, labour and variable overheads (60% of Rs. 80)	Rs. 48
Variable selling and distribution (10% of Rs. 80)	8
	56
Contribution per tonne	24
Total contribution (9,000 × 24)	Rs. 2,16,000
Less : Fixed costs (50,000 + 60,000 + 40,000)	1,50,000
Budgeted profit	66,000

Incremental profit on export order

Export order	= 3,000 tonne
C.I.F. price	= \$6
Less : Commission to foreign agent, freight and insurance	1
Net realisation per tonne	\$5

Net realisation in Rupees (10×5)		Rs 50
Less : Variable cost (60% of Rs. 80)		48
Contribution per tonne		2
Total contribution	Rs. 6,000	
Add : Export incentive licence value (20% of 3,000 tonne @ Rs. 60)	Rs. 36,000	
Less : Difference cost (between 90% and 120% capacity)		42,000
Factory expenses (Rs. 70,000—50,000)	= Rs 20,000	
Fixed factory cost (Rs. 65,000—60,000)	= 5,000	
Additional expenses	10,000	35,000
Incremental profit on exports		7,000

The company should accept the export order, with this the total profit will be Rs. 66,000 + 7,000 = Rs 73,000 in 1984.

MODERNISATION DECISIONS

Replacement of conventional machine by a special purpose machine

Problem 10-22. Shiplon Products Ltd., manufactures 3 different products. The relevant data of these products are as under :

Name of the product	Cream	Pomade	Jelly
Production capacity (units)	5,000	7,000	8,100
Machine hours per unit	1	3	4
Variable cost per unit Rs.	3.00	2.50	3.50
Selling price—Rs./unit	4.00	5.50	6.00

The total fixed overheads at current capacity level are Rs. 40,000 per annum.

The company has various alternatives for improving profitability as given below :

(a) To stop the production of Jelly and use the released capacity for producing Pomade. The machines for both the products are common. However cream is produced on a special purpose machine.

(b) To export the total production of Jelly at current price. On export the following additional revenue is expected :

- 8% Duty Drawback on export price.
- 12% Cash Compensatory Support against an export scheme of government.
- 5% Replenishment licence which can be sold in market at a premium of 80%.

(c) To replace the conventional machine used for Jelly by a special purpose machine which will reduce the production time from 4 hours to 3 hours per unit. Due to this change the variable cost of Jelly will be reduced by Rs. 0.50 per unit. The released machine will be used for producing Pomade. This proposal will entail an additional burden of fixed cost to the tune of Rs. 32,000 per annum.

Please advise the management about the right choice of an alternative so as to maximise profits. (I.C.W.A. Final, June 1985)

Solution : Shiplon Products Ltd.

(a) Profitability under the existing production schedule

Details	Cream	Pomade	Jelly	Total
No. of units	5,000	7,000	8,100	
Selling price Rs./unit	4.00	5.50	6.00	
Variable cost Rs./unit	3.00	2.50	3.50	
Contribution per unit	1.00	3.00	2.50	
P/V ratio	25%	54.55%	41.67%	
Total contribution	5,000	21,000	20,250	46,250
Less : Fixed cost				40,000
Net profit				6,250
No. of machine hours per unit	1	3	4	
Contribution per machine hour	Rs. 1.00	1.00	0.625	
Total machine hours required	5,000	21,000	32,400	

Note : Cream is produced on a special purpose machine. However, Pomade and Jelly are produced on a common machine. Under the present scheme Jelly is yielding lower P/V ratio than Pomade. The contribution per machine of Jelly is even lower than cream. Therefore, production of Jelly is completely stopped and the 32,400 machine hours are diverted to manufacture of Pomade. The revised production of Pomade will be as under :

Existing production	7,000 units
Additional production of Pomade by utilizing additional 32,400 machine hours (3 hours are needed to produce one unit of Pomade)	10,800 units
	<u>17,800 units</u>

Profitability under the revised production schedule (production of Jelly to be discontinued)

Details	Cream	Pomade	Total
Production (units)	5,000	17,800	
Contribution per unit	Rs. 1.00	3.00	

Total contribution	Rs. 5,000	53,400	58,400
Less : Fixed cost			40,000
Net profit			18,400

It is noticed that the revised net profit has improved considerably.

(b) Profitability when total production of Jelly is exported

Export price				<i>Jelly</i> Rs. 6'00
Add : (i) Duty drawback on exports (8% of Rs. 6'00)	Rs. 0 48			
(ii) Cash compensatory (12% of Rs. 6'00)	0'72			
(iii) Subsidy benefit (80% of 5% of Rs. 6'00)	0'24			1'44
Revised revenue on exports				7'44
Less : Variable cost				3'50
Contribution				3'94
<i>Details</i>	<i>Cream</i>	<i>Pomade</i>	<i>Jelly</i> (exports)	<i>Total</i>
Production in units	5,000	7,000	8,100	
Contribution per unit	Rs. 1'00	3'00	3'94	
Total contribution	Rs. 5,000	21,000	31,914	57,914
Fixed cost				40,000
Net profit				Rs. 17,914

(c) A special purpose machine will now be used for production of Jelly. The production time will thus be reduced from 4 hours to 3 hours per unit. Thus, there will be a saving of 1 hour per unit and total hours saved will be $8,100 \times 1 = 8,100$ hours.

Additional units of Jelly = $8,100 \div 3$ hours	2,700 units.
Existing production	8,100

Revised production of Jelly 10,800

It should be noted that the released machine will be used for producing Pomade. So the production of Pomade in the multi-purpose machine will be 17,800 units.

Profitability when a special purpose machine is used for production of Jelly

<i>Details</i>	<i>Cream</i>	<i>Pomade</i>	<i>Jelly</i>	<i>Total</i>
Production in units	5,000	17,800	10,800	
Contribution per unit	Rs. 1'00	3'00	3'00	
Total contribution	Rs. 5,000	53,400	32,400	90,800
Less : Fixed cost (40,000 + 32,000)				72,000
Net profit				18,800

The net profits under various alternatives :

1. Under existing production schedule	Rs. 6,200
2. Production of Jelly to be stopped and available time is spent on production of Pomade	18,400
3. Total production of Jelly is exported	17,914
4. Jelly to be produced in a special purpose machine	18,800

Fourth proposal, i.e., when Jelly is produced on a special purpose machine, is most profitable proposition. But second proposal is also quite attractive. Therefore, before taking a final decision, other non-cost factors should be considered.

Modernisation Decisions (Replacement of old model machine)

Problem 10-23. A company has just installed a machine Model A for the manufacture of a new product at a capital cost of Rs. 1,00,000. The annual operating costs are estimated at Rs. 50,000 (excluding depreciation) and these costs are estimated on the basis of an annual volume of 1,00,000 units of production. The fixed costs at this volume of output will amount to Rs. 4,00,000 per annum. The selling price is Rs. 5 per unit of output. The machine has a five-year life with no residual value.

The company has now come across another machine called Super Model which is capable of giving the same volume of production at an estimated annual operating costs of Rs. 30,000 exclusive of depreciation. The fixed costs will, however, remain the same in value. This machine also will have a five-year life with no residual value. The capital cost of this machine is Rs. 1,50,000.

The company has an offer for the sale of the machine Model A (which has just been installed) at Rs. 50,000 and the cost of removal thereof will amount to Rs. 10,000. Ignore tax.

In view of the lower operating cost, the company is desirous of dismantling the machine Model A and installing the Super Model Machine. Assume that Model A has not yet started commercial production and that the time lag in the removal thereof and the installation of the super model machine is not material.

The cost of capital is 14% and the P.V. Factors for each of the five years respectively are 0.877, 0.769, 0.675, 0.592 and 0.519.

State whether the company should replace Model A machine by installing the super model machine. Will there be any change in your decision if the Model A machine has not been installed and the company is in the process of consideration of selection of either of the two models of the machine? Present suitable statements to illustrate your answer.

(C.A. Final, Nov. 1988)

Solution : Computation of Cash Inflows

	Model A	Super Model
Annual output (units)	1,00,000	1,00,000
Selling price per unit	Rs. 5	Rs. 5

Sales value	3,00,000	5,00,000
Less : Operating costs	50,000	30,000
Fixed costs	4,00,000	4,00,000
Annual cash inflows	50,000	70,000

When Model A has been installed

- When installation of Super Model is considered, the cost of Model A (Rs. 1,00,000) is a sunk cost and the same is not relevant for decision-making.

Cash Outflow of Super Model Machine

Capital Cost		Rs. 1,50,000
Less : Sale of Model A	50,000	
Removal Cost (—)	10,000	
		40,000
		1,10,000

Net Incremental Cash Inflow

Annual cash inflows from Super Model	70,000
Less : Annual cash inflows from Model A	50,000
Net incremental cash inflows	20,000
Present value of cash inflows for 5 years	
$= \text{Rs. } 20,000 \times 3.432^*$	Rs. 68,640
Present value of Super Model	1,10,000
NPV of Super Model	(41,360)

$$* 0.877 + 0.769 + 0.675 + 0.592 + 0.519 = 3.432$$

Since the NPV is negative, it is not advisable to replace Model A by Super Model

If both are considered as independent proposals

	Model A	Super Model
Cash outflows	Rs. 1,00,000	Rs. 1,50,000
P.V. of cash inflows for 5 years		
Model A $= 50,000 \times 3.432$	1,71,600	
Super Model $70,000 \times 3.432$		2,40,240
Net Present Value	1,600	90,240

Installation of Super Model is recommended provided that Model A has not been installed at the point of decision-making.

Problem 10-24. (Choice of best airconditioning system)
Cosy Comforts Associates propose to instal a central air-conditioning system in their city office building. As part of the Company's long range plan, the office building is due to be disposed off on 31st December 1990 and the company believes that whichever system is installed, it will add some Rs. one lakh to the resale value at that time. Three systems—gas, oil and solid fuel—are regarded as feasible. Cosy Comforts Associates estimate that the costs of installing and running the three systems are as follows :

(i) Installation costs (payable on 1st January 1988) :

Gas	Rs. 1,70,000
Oil	1,50,000
Solid Fuel	1,40,000

(ii) Annual Fuel costs (payable at the end of each year) :

Annual fuel costs will depend on the severity of the weather each year and on the rate of increase in fuel prices. At the prices expected to exist during 1988, annual fuel costs will be :—

	Severe weather	Mild weather
Gas	Rs. 40,000	Rs. 24,000
Oil	53,000	37,000
Solid Fuel	45,000	36,000

The Company estimates that in each year there is a 70% chance of severe weather and a 30% chance of mild weather. The chance of particular weather in any one year is independent of the weather in other years.

Fuel prices during 1989 and 1990 are expected to increase at either 15% per annum (probability equal to 0.4) or 25% per annum (probability equal to 0.6). Whichever rate of price increase obtains in 1989 will be repeated in 1990.

(iii) Maintenance cost (payable at the end of the year in which they are incurred)

Gas	Rs. 2,500 per annum
Oil	2,000 per annum
Solid Fuel	10,000 in 1989

All maintenance costs are fixed by contract when the system is installed. Cosy Comforts Associates feel that the systems are equivalent for air-conditioning purposes. They have a cost of capital of 20% per annum in money terms.

(a) Prepare calculations showing which central air-conditioning system should be installed, assuming that the decision will be based on the expected present values of the costs of each system.

(b) The discounting factors at 20% for years 1, 2 and 3 are 0.833, 0.694 and 0.579 respectively.

(I.C.W.A. Final, December 1987)

Solution. Expected Fuel Cost

	Severe weather	Mild weather	Expected cost
Gas $(40,000 \times 0.70) +$	$(24,000 \times 0.30)$		Rs. 35,200
Oil $(53,000 \times 0.70) +$	$(37,000 \times 0.30)$		18,200
Solid Fuel $(45,000 \times 0.70) +$	$(36,000 \times 0.30)$		42,300

Fuel costs are expected to increase at the expected rate of $(15\% \times 0.40) + (25\% \times 0.60) = 21\%$.

(NPV of Cash Flows of various alternatives)

Gas	0	1	2	3
Year				
Installation	1,70,000			
Fuel Costs		35,200	42,592	51,536
Maintenance		2,500	2,500	2,500

Cash Flows	1,70,000	37,700	45,092	54,036
Discounting Factor	—	0.833	0.694	0.579
NPV	1,70,000	31,404	31,294	31,287

Total NPV = 2,63,985 in Gas system.

Oil

Year	0	1	2	3
Installation	1,50,000			
Fuel Costs		48,200	58,322	70,570
Maintenance		2,000	2,000	2,000
	1,50,000	50,200	60,322	72,570
Discounting Factor	—	0.833	0.694	0.579
NPV	1,50,000	41,817	41,863	42,018

Total NPV = 2,75,698 in oil system

Solid Fuel

Year	0	1	2	3
Installation	1,40,000			
Fuel	—	42,300	51,183	61,931
Maintenance	—	—	10,000	—
Cash Flows	1,40,000	42,300	61,183	61,931
Discounting Factor	—	0.833	0.694	0.579
NPV	1,40,000	35,236	42,461	35,858

Total NPV = Rs. 2,53,555 for solid fuel system

Comment. Since NPV of cash flow is lowest in solid fuel, this alternative is recommended of the proposed three alternatives. However, this alternative should be recommended comparing the following two factors.

- Value of present system (not given)
- Present value of cash flows due to enhancement of building i.e.
Rs. $1,00,000 \times 0.579$ = Rs. 57,900.

Therefore net cost of solid fuel system = Rs. 2,53,555 – Rs. 57,900
= Rs. 1,95,655.

∴ This solid fuel system should be introduced when present air conditioning cost is greater than Rs. 1,95,655.

Introduction of a new machine

***Problem 10-25.** Navyug Enterprises is considering the introduction of a new product. Generally, the company's products have a life of about five years, after which they are usually dropped from the range of products the company sells.

The new product envisages the purchase of new machinery costing Rs. 4,00,000 including freight and installation charges. The useful life of the equipment is five years, with an estimated salvage value of Rs. 1,57,500 at the end of that time. The machine will be depreciated for tax purposes by the reducing balance method at a rate of 15% on the book value.

The new product will be produced in a factory which is already owned by the company. The company built the factory some years ago at Rs. 1,50,000. The book value on the written down value basis is zero.

Today the factory has a resale value of Rs. 3,50,000 which should remain fairly stable over the next five years. The factory is currently being rented to another company under a lease agreement, which has five years to run, and which provides for an annual rental of Rs. 5,000. Under the lease agreement, if the lessor wishes to cancel the lease, he can do so by paying the lessee compensation equal to one year's rental payment. This amount is not deductible for income tax purposes.

Additions to current assets will require Rs. 22,500 at the commencement of the proposal which, it is assumed, is fully recoverable at the end of year 5. The company will have to spend Rs. 50,000 in year 1 towards market research.

The net cash inflows from operations before depreciation and income tax are :

Year	Rs.
1	2,00,000
2	2,50,000
3	3,25,000
4	3,00,000
5	1,50,000

It may be assumed that all cash flows are received or paid at the end of each year and that income taxes are paid in the year in which the inflow occurred.

The company's tax rate may be assumed to be 50% and the company's required return after tax is 10%.

Required : Evaluate the proposal.

(C.A. Final, May 1987)

Solution : Before evaluation of the proposal, it is necessary to compute cash outflows and cash inflows, depreciation, income tax and net cash flows :

(a) Cash outflows

Cost of new machinery	Rs. 4,00,000
Payment on account of cancellation of lease	5,000
Working capital	22,500
Total cash outflow	4,27,500

(b) Expenditure towards market research	50,000
Less : Tax saving @ 50%	25,000

Net cash flow (First year only)	<u>25,000</u>
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(c) Opportunity cost (Factory rent forgone due to cancellation of lease)	5,000
Less : Tax saving	2,500

Net cash flow (To be considered each year for 5 years)	<u>2,500</u>
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(d) Computation of depreciation @ 15% W.D.V., Income tax, and net cash flow from operations.

Year	Book value	Depreciation @ 15% W.D.V.	Cash flows from operations	50% tax on (col. 4— col. 3)	Net cash flows (before depre- ciation but after income tax (col. 4— col. 5))
(1)	(2)	(3)	(4)	(5)	(6)
1	Rs. 4,00,000	Rs. 60,000	Rs. 2,00,000	Rs. 70,000	Rs. 1,30,000
2	3,40,000	51,000	2,50,000	99,500	1,50,500
3	2,89,000	43,350	3,25,000	1,40,825	1,84,175
4	2,45,650	36,848	3,00,000	1,31,576	1,68,424
5	2,08,802	31,320	1,50,000	59,340	90,660

Note : Depreciation will not affect the cash flows. Therefore, net cash flows from operations have been taken before depreciation.

(e) Sales of machinery

Book value at the end of 5th year	Rs. 2,08,802
Less : Depreciation	31,320

	<u>1,77,482</u>
Less : Salvage value	1,57,500

Loss in sale of machinery	<u>19,982</u>
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Tax saving (50% of 19,982)	Rs. 9,991
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Cash flow in the 5 years due to sale of machinery will be
Rs. 1,57,500 + 9,991 = 1,67,491.

- (f)** It is given that addition to current assets will require Rs. 22,500 at the commencement of the proposal. It means that Rs. 22,500 will appear before the start of first year cash outlay only. This amount is fully recoverable at the end of year 5. In year 5, it will be shown as cash inflow.

- (g) The company's required rate of return after tax is 10%. It means net cash flows will be reduced to present value by applying 10% of P.V. factor.

Computation of Net Present Value of the proposal

Year	Cash outflows	Cash inflows	Net cash flows	P.V. factor @ 10%	Net present value
0	(4,27,500*)	—	(4,27,500)	1.000	(4,27,500)
1	25,000 } 2,500 }	1,30,000	1,02,500	0.909	93,173
2	2,500	1,50,500	1,48,000	0.826	1,22,248
3	2,500	1,84,175	1,81,675	0.751	1,36,438
4	2,500	1,68,424	1,65,924	0.683	1,13,326
5	2,500	90,660 } 1,67,491 } 22,500 }	2,78,151	0.621	1,72,732
Net present value					2,10,417

It is recommended that the new product should be introduced in the market as the NPV of the proposal is positive.

*As per working at (a) above.

Replacement of existing machine by new one

Problem 10.26. A manufacturing unit is producing 15,000 containers per annum. There is good demand in local as well as export market. The unit is thinking of replacing the present production machine by an automatic machine. Due to this change, the production will be doubled. The present selling price of each container is Rs. 20. The new machine will be operated by one labour while the present machine is operated by two operators. Value of the new machine is Rs. 4,00,000 with no scrap value. The old machine has book value of Rs. 1,60,000 and has scrap value of Rs. 10,000. The unit is charging 10% depreciation. The cost structure of containers is as follows :

	Rs. per unit
Direct material	6.00
Direct labour	4.00
Variable overheads	2.00
Fixed overheads (including Depreciation)	2.00

After the new machine is commissioned there will be an increase in fixed overheads (excluding depreciation) by Rs. 15,000 per annum.

- (a) Calculate present and future profitability assuming no change in selling price.

(b) In case the local market demand falls and the new machine is having 80% idle capacity, will it be feasible to offer the product in export market at a selling price of Rs. 10.50 per unit? Will your recommendations differ if the export price is Rs. 9.50 per container as against Rs. 10.50?

(I.C.W.A. Final, June 1985)

Solution : (a) Statement showing the present and future profitability of manufacturing containers

Particulars	Present	Future
Production (units)	15,000	30,000
Sales @ Rs. 20 per container	Rs. 3,00,000	6,00,000
Less : Variable costs :		
Direct material	90,000	1,80,000
Direct labour	60,000	60,000
Variable overheads	30,000	60,000
Total variable cost	1,80,000	3,00,000
Contribution	1,20,000	3,00,000
Less : Fixed overhead (including depreciation)	30,000	70,000*
Profit	90,000	2,30,000
P/V ratio	40%	50%
Profit as a % of sales	30%	38.33%

*The present fixed overhead is Rs. 30,000 (15,000 units × Rs. 2) and it includes an element of depreciation. The depreciation amount included in the fixed overheads is computed as under :

$(\text{Book value} - \text{Scrap value}) \times \text{Rate of depreciation}$ (Rs. 1,60,000 - 10,000) = Rs. 1,50,000 × 10% = Rs. 15,000.

Therefore in the present fixed overheads, depreciation of Rs. 15,000 is included. The future fixed overheads will work out to :

Present fixed overheads excluding depreciation	Rs. 15,000
Increase in fixed overheads due to new machine	15,000
Depreciation of new machine (Rs. 1,00,000 × 10%)	40,000
	<u>70,000</u>

Note : It is assumed that the depreciation is on straight line basis.

The profitability of the new machine is much more than the present one. Therefore, the management should instal the new machine.

(b) Revised selling price per unit Rs. 10.50 Rs. 9.50

Less : Variable cost per unit :

Direct material	6'00		
Direct labour	2'00		
Variable overheads	2'00	10'00	10'00

Contribution		+0'50	-0'50
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The export price of Rs. 9'50 per unit is not recommended as the variable cost is more than this price. However, at a unit price of Rs. 10'50, there is some contribution. This proposal should be accepted as the management has no option but export the product at Rs. 10'50 per unit. The demand within the country has dipped sharply and the new machine is working at 20% capacity utilization. It is suggested that the company should boost both indigenous sales as well as exports. The profitability at 20% capacity utilization works out to :

Production at 20% capacity	6,000 units
Contribution = Rs. 20-10	Rs. 10 per unit
Total contribution—6,000 × 10	Rs. 60,000
Less : Fixed cost	70,000
Loss	10,000

PRODUCTION DECISIONS

Imbalanced capacity—installing new machine

Problem 10-27. A company manufacturing agricultural tractors has a capacity to produce 6,000 tractors annually. The capital employed in the project as on date is Rs. 20 crores. With increasing cost of production and reducing margins, the company is fast narrowing its margin of safety. The return on capital employed fell from 10% in the previous year to 6% in the current year, i.e., the current year profit is 1'20 crores. The company wants to maintain the original cut-off rate of 12% and various possibilities have been examined for this purpose.

The company is at present manufacturing and marketing 6,000 tractors annually though there is imbalance in the plant. The company has the following major production departments with percentage capacity utilisation for the present production :

<i>Production department</i>	<i>Capacity utilised</i>
Machine shop	75%
Assembly shop	100%
Heat treatment shop	75%
Induction hardening	50%

The company operates a single shift of 8 hrs. per day on an average for 300 days in a year. For technical reasons the plant will have to operate on single shift basis only.

The two alternatives which have emerged after a detailed study are :

(a) To hire out the surplus capacity in the production shop for

which constant demand exists. The following income and expenditure projections are drawn out :

	<i>Hire charge per hour</i>	<i>Incremental cost per hour</i>
Machine shop	Rs. 10,000	Rs. 2,000
Heat treatment shop	7,500	1,500
Induction hardening	5,000	1,000

(b) To increase the installed capacity to 8,000 tractors by spending Rs. 2 crores on additional machinery for the assembly shop. The incremental revenue from the additional sales will be Rs. 5,000 per tractor. The cost of additional finance will be 12% being the cost of existing capital employed. In addition, tax benefits on an average will work out to 1% of additional investment.

You are required :

(i) To work out the profitability, i.e., average rate of return of the two alternatives ; and

(ii) To comment on the advisability of maintaining an imbalanced plant from a long-term point of view.

C.A. Final November, 1981 ; I.C.W.A. Final June, 1989)

Suggested Approach :

In this company, a peculiar situation exists because there is unutilised capacity in three out of four production departments. When alternative (a) is resorted to, differential profit on hiring the existing unutilised capacity to outside parties should be found out. The existing profit is added to arrive at the total profit. The total profit thus arrived at will represent the return on capital employed of Rs. 20 crores under alternative (a)

When the installed capacity is increased from 6,000 tractors to 8,000 tractors, there will be an increase in production of 2,000 tractors. The time required for producing 2,000 more tractors will be as follows :

<i>Production</i>	<i>Hours required for producing 2,000 tractors</i>
Machine shop	$\frac{1,800 \text{ hrs.}}{6,000 \text{ tractors}} \times 2,000 \text{ tractors} = 600 \text{ hours}$ (i.e., all the excess hours will be utilised)
Assembly shop	Already 100% capacity utilised
Heat treatment shop	$\frac{1,800 \text{ hrs.}}{6,000 \text{ tractors}} \times 2,000 = 600 \text{ hours}$ (i.e., all the excess capacity will be utilised)
Induction hardening	$\frac{1,200 \text{ hrs.}}{6,000 \text{ tractors}} \times 2,000 = 400 \text{ hours}$

(i.e., only 400 hours out of 1,200 excess hours will be utilised.

The balance of 800 unutilised hours can be used for hiring out).

Thus, in alternative (b), the differential revenue will be the contribution of 2,000 tractors *plus* profit from hiring out 800 hours still unutilised in respect of induction hardening shop and 1% incentive on investment.

Solution :

At the very outset, a statement should be prepared showing available capacity, utilised capacity and unutilised capacity in different shops.

Production department	Available hours during the year (300 × 8) hrs.	Utilised		Unutilised	
		Capacity %	Hrs.	Capacity %	Hrs.
Machine shop	2,400	75	1,800	25	600
Assembly shop	2,400	100	2,400	—	—
Heat treatment shop	2,400	75	1,800	25	600
Induction hardening	2,400	50	1,200	50	1,200

(i) (a) Statement showing the average rate of return when the surplus capacity is hired out

Incremental Revenue :

Machine shop	600 hrs. @ Rs. 10,000/hr.	=	60,00,000
Heat treatment	600 hrs. @ Rs. 7,500/hr.	=	45,00,000
Induction hardening	1,200 hrs. @ Rs. 5,000/hr.	=	60,00,000

Total revenue 1,65,00,000

Less : Incremental cost

Machine shop	600 hrs. @ Rs. 2,000/hr.	12,00,000
Heat treatment	600 hrs. @ Rs. 1,500/hr.	9,00,000
Induction hardening	1,200 hrs. @ Rs. 1,000/hr.	12,00,000
		<u>33,00,000</u>

Profit on hiring 1,32,00,000
Existing profit 1,20,00,000

Total profit 2,52,00,000

Total capital employed 20,00,00,000

Return on capital employed = $\frac{2,52,00,000}{20,00,00,000} \times 100$ or 12.6%.

(i) (b) Statement showing the Average Rate of Return when capacity is increased by 2,000 Tractors

Incremental revenue from 2,000 tractors Rs.
(2,000 tractors @ Rs. 5,000 per tractor) 1,00,00,000

Net incremental revenue from 800 hrs. in induction hardening (Rs. 5,000 revenue less Rs. 1,000 cost Rs. 4,000 net incremental revenue) (800 hrs. @ Rs. 4,000 per hr.)	32,00,000
Add : 1% of additional investment	2,00,000
Total incremental revenue	1,34,00,000
Existing profit on 6,000 tractors	1,20,00,000
Total profit	2,54,00,000
Total capital employed (Rs. 20,00,00,000 + Rs. 2,00,00,000)	22,00,00,000
Return on capital employed = $\frac{2,54,00,000}{22,00,00,000}$	or 11.55%.

When the surplus capacity is rented out, the rate of return is 12.6% and when the capacity is increased by 2,000 tractors, the rate of return is 11.55%. Therefore, it is recommended that the company should opt for renting out excess capacity of the three shops.

(c) Comments on maintaining the imbalanced plant

Imbalance in the plant means that there is excess capacity in some departments and the capacity in a particular department does not match with the capacity in other departments. Imbalance in plant capacity involved excess investment in plant and machinery. The company cannot make best use of its plant facilities. It is, therefore, recommended that imbalance in plant capacity should be discouraged. Imbalance in the plant capacity can be corrected by installing additional equipment provided there is a sufficient demand of the product.

Some companies install excess capacity in some of the production departments. This is intentionally resorted to get their capacity regularised when the government announces some liberal policy for regularisation of capacity.

Decision for diversification

Problem 10-28. A company manufactures 3 lac units of product X and 2 lac units of products Y per annum. The following figures are extracted from its cost books related to the costs of above products.

Sale value	Rs. 38.00 Lacs
Direct material	7.00 "
Direct labour	9.50 "
Factory overheads	9.50 "
Administration and selling overheads	6.00 "

50% of factory overheads are variable and 50% of administration and selling overheads are fixed. The selling price of X is Rs. 6 per unit and Y is Rs. 10 per unit. The direct material and labour ratio for product

X is 1 : 1.5 and for Y is 1 : 1.25. For both the products, the selling price is 400% of direct labour. The factory overheads are charged in the ratio of direct labour and administration and selling overheads are recovered at a flat rate of Re. 1 per unit of X and Rs. 1.50 per unit of Y .

Due to fall in demand of the above products, the company has a plan to diversify and make product Z using 40% of the present capacity. It has been estimated that for Z direct material and labour will be Rs. 1.25 and Rs. 1.50 respectively. Other variable costs will be same as applicable to product X . The selling price of Z will be Rs. 7 per unit and production will be 3 lac units.

Assuming that balance 60% capacity is used for manufacture of X and Y , (a) calculate present costs and profits and (b) costs and profits after the diversification is implemented and (c) your recommendation as to whether to diversify or not
(I.C.W.A. Final, June 1986)

Solution :

(a) **Statement showing the present costs and profits**

	X	Y	Total
Production and sales (units in lacs)	3.00	2.00	5.00
Sales value (Rs. in lacs)	18.00	20.00	38.00
Variable cost :			
Direct material	3.00*	4.00*	7.00
Direct labour	4.50	5.00	9.50
Variable factory overheads	2.25	2.50	4.75
Variable administration and selling overheads	1.50	1.50	3.00
Total variable costs	11.25	13.00	24.25
Contribution	6.75	7.00	13.75
P/V ratio	37.50%	35.00%	36.18%
Less : Fixed factory overheads (50%)			4.75
Fixed admin. and selling overheads (50%)			3.00
Net profit			6.00
			== ==

*In this problem, two clues for finding unit cost are given : (a) direct material and direct labour ratios for both the products are given and (b) selling price for both the products is 400% of direct labour. Therefore, the unit variable costs of products X and Y are as under :

	Per unit	
	X	Y
Selling price (Rs.)	6.00	10.00

Direct material	1.00	2.00
Direct labour (one-fourth of S.P.)	1.50	2.50
Variable factory overheads (100% of direct labour out of which 50% is variable)	0.75	1.25
Variable admin. and selling overheads	0.50	0.75
Total variable costs	3.75	6.50
Contribution	2.25	3.50

Note : The variable costs for 3 lac units of X and 2 lac units are arrived at by multiplying unit variable costs with 3 and 2 respectively.

(B) Statement showing costs and profits after diversification

Capacity	60% of (a)		40%	Total
	X	Y	Z	
Production and sales (units in lacs)	1.80	1.20	3.00	6.00
Sales value (Rs. in lacs)	10.80	12.00	21.00	43.80
Variable costs :				
Direct materials	1.80	2.40	3.75	7.95
Direct labour	2.70	3.00	4.50	10.20
Variable factory overhead	1.35	1.50	2.25	5.10
Variable administration and selling overheads	0.90	0.90	1.50	3.30
Total variable cost	6.75	7.80	12.00	26.55
Contribution	4.05	4.20	9.00	17.25
P/V ratio	37.50%	35.00%	42.86%	39.38%
Total contribution				17.25
Less : Fixed factory overheads				4.75
Fixed administration and selling overheads				3.00
Net profit				9.50

(c) Recommendations. The company should immediately implement the proposed diversification because :

(i) The net profit has increased from Rs. 6 lacs to Rs. 9.50 lacs.

(ii) There is overall improvement in the P/V ratio (39.38% as against 36.18%).

As P/V ratio of product Y is minimum its production should be reduced by increasing production of either Z or X.

Discontinue unprofitable factories

Problem 10-29. A manufacturing company is having three factories X, Y and Z located at different places. The factories produce same product independently. Due to recession, the production capacity is not fully utilized. The management is thinking of running one of the factories at full capacity and close down two of them. The normal capacity of factory X is proposed to be raised to Rs. one crore in terms of sale value. The annual cost data relating to these factories is as under :

(Rs. Lacs)

(a) Product cost data :	X	Y	Z
Direct material	7.0	4.0	6.0
Direct labour	4.0	2.0	1.5
Variable overheads	2.0	1.0	1.0
Fixed factory overheads	12.0	8.0	18.0
Admn. and selling overheads	9.0	5.0	10.0
Sale value	35.0	20.0	30.0
(b) Other data/closing costs :			
(i) Cost of closure	2.0	3.0	3.0
(ii) Cost of disposal	3.0	1.0	2.0
(iii) Employee transfer cost	3.0	2.0	1.0
Selling price of plant	6.0	5.0	10.0
Capital employed	120.0	160.0	90.0
Capacity utilisation	40%	25%	30%

If one of the factories is continued to operate, the administration and selling overhead costs will be Rs. 14 lacs at normal capacity utilisation of one crore sale value. However, if additional production is required in any one of these factories, the labour cost will increase by 10% of the labour cost of such additional capacity due to overtime work.

You are required to advise the management :

(a) Which factory should get preference for continuation considering (i) Contribution, (ii) Profits, (iii) Return on capital employed and (iv) Capacity constraints.

(b) State what other considerations should be taken into account for selecting the preferred factory, other than those mentioned in (a) above.
(I.C.W.A. Final, June 1986)

Solution :

(a) Statement showing the contribution and profit of each factory presuming other two factories are closed

	(Rs. lacs)		
	X	Y	Z
Increased sales value	100.00	100.00	100.00
Variable costs :			
Direct material	20.00	20.00	20.00

Direct labour	11.43	10.00	5.60
Increased labour cost due to overtime	0.14*	0.20*	—
Variable overheads	5.71	5.00	3.33
Total variable costs	37.28	35.20	28.33
Contribution (S—V)	62.72	64.80	71.67
<i>Less fixed costs :</i>			
Fixed factory overheads	12.00	8.00	18.00
Admn. and selling overheads	14.00	14.00	14.00
Profit	36.72	42.80	39.67
Capital employed	120.00	160.00	90.00
Return on C.E.	30.60%	26.75%	44.08%
	===	===	===

*It is given that if additional production is required in any one of these factories, the labour cost will increase by 10% of the labour cost of such additional capacity due to overtime work. Therefore, it is necessary to find out additional capacity required for production worth Rs. 1 crore, additional labour cost and increased labour cost due to overtime.

	(Rs. lacs)		
	X	Y	Z
Increased sales value	100.00	100.00	100.00
Existing capacity $\left(\frac{\text{Sales value}}{\text{Capacity utilization}} \times 100 \right)$	87.50	80.00	100.00
Additional capacity required	12.50	20.00	—
Additional labour cost (for deciding overtime)	1.43	2.00	—
Overtime (10% of additional labour cost)	0.14	0.20	—

Thus, the ranking will be :

(i) Contribution	Z	Y	X	} Factory Z should be given the first preference
(ii) Profit	Y	Z	X	
(iii) Return on capital	Z	X	Y	
(iv) Capacity constraints	Z	X	Y	

No additional capacity is required for factory Z as available capacity and required capacity is the same. Factory X requires Rs. 12.5 lacs additional capacity while Factory Y requires Rs. 20.0 lacs additional capacity.

(b) Other consideration for selecting the factory :

1. Employees transfer cost should be considered.
2. It is assumed that there is no change in fixed overheads due to increase in capacity of factories X and Y.

3. Factory Z has the lowest labour cost and variable overheads.
4. Uniform basis of valuation of assets should be adopted.
5. Locational advantages of each factory should be considered before hand.
6. Scope for further expansion facilities should be found out.

Off-loading the production

Problem 10-30. Soloproducts Ltd. produces and sells one product in the Southern and Northern parts of the country. The company normally sells 3,00,000 units of the product per year at the following expenses per unit :

Cost of goods sold :	Rs.
Direct materials	3.20
Direct labour	4.35
Variable factory overheads	3.10
Fixed Factory overhead	2.35
Other Expenses :	
Variable selling	1.35
Fixed administration	0.65
	<hr/>
	15.00 .
	<hr/>

Soloproducts receives an offer from Helping Hand Ltd., that it would produce the product for Soloproducts customers in the Northern market at an expense of Rs. 14.50 per unit. In such a case, Soloproducts would merely forward its northern sales orders to Helping Hand. It would still bill the northern customers at the regular price and collect all receivables. The annual sales to the northern market are 1,00,000 units of the product. If Soloproducts were to accept this offer, total fixed factory overheads would be reduced by 30%. Consequently upon the production of the 2,00,000 units and variable selling expenses would be cut by 40% on the sale of the 1,00,000 units. Should Soloproducts accept or reject the offer ?

Would your answer change, if Soloproduct maintained the same fixed factory overhead costs but was able to rent its idle plant facilities at Rs. 4,00,000 per year ? (I.C.W.A. Final, June 1984)

Solution : Variable cost per unit :

Direct material	Rs. 3.20
Direct labour	Rs. 4.35
Variable factory overheads	Rs. 3.10
Variable selling overheads	Rs. 1.35
	<hr/>
	Rs. 12.00
	<hr/>

By selling 10,000 units in Northern Market produced by Helping Hand :

Cost avoided (1,000 units \times Rs. 12'00)	Rs. 12,00,000
Costs saved in fixed factory overhead 30% of (3,00,000 \times 2'35)	Rs. 2,11,500
	<hr/>
	Rs. 14,11,500
Less : Costs to be incurred on variable selling expenses 60% of 1,00,000 \times 1'35	Rs. 81,000
	<hr/>
Total savings	Rs. 13,30,500
	<hr/>
Amount to be paid to Helping Hand Ltd.	14,50,000

Since amount to be paid to M/s. Helping Hand Ltd. is more than the saving, the proposal should be rejected.

Alternate Proposal

	Rs.
Cost avoided	12,00,000
Less : Cost to be incurred on selling expenses	81,000
	<hr/>
	11,19,000
Hire charges on Idle Plant	4,00,000
	<hr/>
	15,19,000
	<hr/>
Against this a total expenditure of	14,50,000

There is a saving in cost of Rs. 69,000 and therefore, proposal should be accepted.

Appraisal of production incentive scheme

*Problem 10-31. The management of Kabra Limited is alarmed at the high underutilisation of installed capacity. The workers of Kabra Ltd. have a very strong union. Any attempt by management to increase production is opposed by the union on the ground that the workers are working as per normal standards and that any extra unit produced does not fetch any reward to workers.

The management having realised that there is excess capacity, puts forth an incentive scheme which rewards the workers, staff as well as management.

As per the proposed scheme, the after-tax incremental profit will be shared by all as follows :

- 30% to be ploughed back,
- 40% to be shared by workers and
- 30% to be shared by staff.

In case there is a loss, no reward will be given to anyone. The changes in capacity due to off-loading, make or buy decision, replacement of conventional machines by highly productive machines, etc. will be adjusted for calculating excess production during the currency of the scheme.

Presently the company is producing 1 lakh units. The current cost and structure is as follows :

	<i>Rs. per 1,000 Units</i>
Prime cost	15,003
Works overheads	7,490
Administration overheads	2,650
Selling overheads	99
Sale Value	25,150

The above figures include fixed cost to the extent of 20% works overheads, 30% administration overheads and 100% selling expenses.

The company pays 50% tax. However, the reward under the scheme given to workers (not staff) is tax deductible.

You are required to calculate the annual share in absolute amounts for each of the beneficiary at various levels at an interval of 1% from 1% to 8% increase in production over present target.

(I.C.W.A. Final, June 1985)

Solution. The current cost and sales value for 1,000 units is given. The present production level is 1 lakh units. Therefore, the current cost and sales value have to be segregated into fixed and variable components and profitability is to be determined :

Production

<i>Variable cost :</i>	<i>1,000 units</i>	<i>1 lakh units</i>
Prime cost	Rs. 15,003	Rs. 15,00,300
Works overheads $7,490 \times 80\%$	5,992	5,99,200
Administration overheads $2,650 \times 70\%$	1,855	1,85,500
Total variable cost	22,850	22,85,000

Fixed cost .

Works overheads $7,490 \times 20\%$	1,498	
Administration overheads $2,650 \times 30\%$	795	
Selling overheads $99 \times 100\%$	99	
	2,392	2,39,200
Sales value (Given)	25,150	25,15,000

Contribution per unit = Rs. 2.30

So the profitability at 1 lakh unit level

\therefore Sales - Variable cost = Fixed cost + Profit

or $25,15,000 - 22,85,000 = 2,39,200 + \text{Profit/loss}$

or Loss = Rs. 9,200.

Now, it is necessary to find out the break-even sales at the present activity level, we know that : $S - V = F + P$

Multiply and divide L.H.S. by S

$$\frac{S(S-V)}{S} = F \quad (\text{At BES, profit is zero})$$

$$\text{or BES } (25,15,000 - 22,85,000) / 25,15,000 = 2,39,200$$

$$\text{or BES} = 2,39,200 \times 25,15,000 / 2,30,000 \quad \text{or Rs. } 26,15,600$$

$$\text{BES in units} = 26,15,600 \div 25.15 = 1,04,000 \text{ units.}$$

Therefore, it is apparent that by increasing production upto 1,04,000 units, the company cannot make any profit. The benefit to workers and staff will accrue only for production in excess of 1,04,000 units.

In the present question, it is required to calculate the annual share in absolute amounts for ploughing back, workers and staff. It is given that after-tax incremental profit will be shared as under :

(a) ploughing back	30%
(b) shared by workers	40%
(c) shared by staff	30%

The tax rate is 50% and the reward given to workers (and not for staff) for increased production is deductible for tax purposes. Therefore, incremental profit, share of workers, and staff and tax element are to be determined :

Suppose the incremental profit	$= x$
Share of the workers	$= y$
Tax	$= t$

Reward given to workers is deductible for tax purposes

$$\text{Therefore } t = \frac{x-y}{50\%} \quad (\text{tax rate } 50\%)$$

$$\begin{aligned} \text{or } 2t &= x - y \\ \text{or } y &= x - 2t \end{aligned} \quad \dots(i)$$

The share of workers is 40% of the incremental profit after tax

$$\text{Therefore } y = (x - t) \times 40\%$$

$$\text{or } y = .4x - .4t \quad \dots(ii)$$

Equating (i) and (ii),

$$x - 2t = .4x - .4t$$

$$\text{or } .6x = 1.6t \quad \text{or } t = 0.375x$$

Substituting the value of t in equation (i)

$$y = x - 2 \times 0.375x \quad \text{or } y = x - 0.75x$$

$$y = 0.25x$$

Therefore, out of the total incremental profit of x , the share of each will be as follows :

Tax	=37.5%
Share of workers	=25.0%

Total	62.5%
Balance	37.5%

The balance 37.5% will be shared equally by staff and the company (for ploughing back).

So the share of staff	=18.75%
The share of company	=18.75%

Now, it is possible to work out the share in absolute amounts for each beneficiary with increase in production at an interval of 1% to 8% increase.

Kabra Ltd.

Statement showing incremental profits, tax and share of each beneficiary

Percentage increase over present production		Incremental profit/loss	Tax (37.5%)	Workers' share (25%)	Staff's share (18.75%)	Ploughing back (18.75%)
%	No of additional units	Rs.	Rs.	Rs.	Rs.	Rs.
1	1,000	Loss				
2	2,000	Loss				
3	3,000	Loss				
4	4,000	BEP				
5	5,000	2,300 (1,000 × 2.30)	862.50	575.00	431.25	431.25
6	6,000	4,600 (2,000 × 2.30)	1,725.00	1,150.00	862.50	862.50
7	7,000	6,900 (3,000 × 2.30)	2,587.50	1,725.00	1,293.75	1,293.75
8	8,000	9,200 (4,000 × 2.30)	3,450.00	2,300.00	1,725.00	1,725.00

Note : Incremental profit will accrue from break-even level. So the incremental profit is calculated by multiplying the contribution per unit with additional units produced with reference to break-even production and sales level. The reader should carefully note this point.

Problem 10-32. SV Ltd. which has established its product 'K' furnishes the following forecast of sales in units for 1988.

	I Quarter	II Quarter	III Quarter	IV Quarter
Units :	12,000	15,000	13,500	9,000

The opening stock on 1.1.1988 is expected to be 10,000 units and the company proposes to maintain a closing stock of 4,500 units on 31-12-1988. The rejection in the process of manufacture of product 'K'

is 12% and the production will be spread out uniformly throughout the year.

Two raw materials 'C' and 'D' are used for the manufacture of product 'K'. At present the company orders inventory of the two raw materials in quantities equivalent to 13 weeks consumption. The management of the company has been advised that considerable economies in provisioning of raw materials can be effected by changing over to the ordering system based on economic order quantities. The Materials Manager has compiled the following data :

	'C'	'D'
Raw material quantity required per unit of output of K. (kgs.)	2.4	4.2
Raw material usage rate/week (kgs)	2,300	4,000
Price per kg. (Rs.)	2.00	4.00
Lead time to obtain deliveries (week)	5	3
Order costs per order. (Rs.)	10.00	10.00
Carrying costs.	20%	25%

As a cost consultant to the company you are required to :

(a) Prepare a production budget and raw material requirement budget for the year 1988.

(b) Calculate the economic order quantity using tabular method for order sizes of 600, 1,200, 1800, 2,400, 3,000 and 3,600.

(c) The company feels that a safety stock should be built up to cover a lead time of 8 weeks and 5 weeks respectively for 'C' and 'D' and increase in the usage of raw materials upto 3,000 kg and 5,000 kg respectively for 'C' and 'D' per week. Calculate the ordering level to meet the above requirement.

(d) Based on the ordering level calculated at (c) above, find the savings arising from switching over to the new ordering system.

(I C.W.A. Final, December 1987)

Solution. (a) *Total Annual sales of K*

12,000 + 15,000 + 13,500 + 9,000

Closing stock

49,500 units
4,500 "

Total

Less : Opening stock

54,000 "
10,000 "

Production of good units

Rejection = 12%.

Production as per budget

Material budget

Quantity/unit

Material requirement

per annum

'C'

2.4 kg

1,20,000 kg

44,000 "

44,000 ÷ 88%

50,000 units

'D'

4.2 kg

2,10,000 kg

(b) *Economic Order Quantity (using tabular method)*

Lot Size	No. of Orders	Average Inventory or $\frac{1}{2}$ of Order size	Ordering Cost @ Rs. 10 per Order	Carrying Cost of Inventory	Total Combined Order Processing and Carrying Cost
EOQ—'C'					
600	200*	300	Rs. 2,000	Rs. 120**	Rs. 2120
1,200	100	600	1,000	240	1,240
1,800	67	900	670	360	1,030
2,400	50	1,200	500	480	980
3,000	40	1,500	400	600	1,000
3,600	33	1,800	330	720	1,050

* $1,20,000 \div 600 = 200$. Other values calculated similarly

** Carrying cost is 20% of average inventory cost or $(300 \times \text{Rs. } 2) \times 20\% = 120$. Other values in the column calculated similarly

\therefore Optimum lot size is 2,400.

EOQ—'D'					
Lot Size	No of Orders	Average Inventory or $\frac{1}{2}$ of Order	Ordering Cost @ Rs. 10 per Order,	Carrying Cost	Total Cost
600	350*	300	Rs. 3,500	Rs. 300**	Rs. 3,800
1,200	175	600	1,750	600	2,350
1,800	117	900	1,170	900	2,070
2,400	88	1,200	880	1,200	2,080
3,000	70	1,500	700	1,500	2,200
3,600	58	1,800	580	1,800	2,380

* $2,10,000 \div 600 = 350$. Other values in column have been calculated similarly.

** $(300 \times \text{Rs. } 4) \times 25\% = 300$. Other values in column calculated similarly.

\therefore Optimum lot size is 1,800.

(c) Note : We know that normal ordering level = Lead time \times Inventory usage rate

Statement showing revised ordering level

	'C' kg	'D' kg
(i) Normal ordering level		
(a) 2,300 kg \times 5 weeks	11,500	
(b) 4,000 kg \times 3 weeks		12,000
(ii) Usage over increased lead time		
(a) 2,300 kg \times 3 weeks	6,900	
(b) 4,000 kg \times 2 weeks		8,000

(iii) Usage increase

(a) $(3,000 - 2,300) \text{ kg} \times 8 \text{ weeks}$	5,600	
(b) $(5,000 - 4,000) \text{ kg} \times 5 \text{ weeks}$		5,000
Revised reordering level	<u>24,000</u>	<u>25,000</u>

Alternatively :

- Revised reorder level for C = Maximum lead time \times Maximum usage
 $= 8 \times 3,000 = 24,000 \text{ kg}$.

Revised reorder level for D = $5 \times 5,000 = 25,000 \text{ kg}$

(b) Statement showing economy of introducing new order system

	'C'	'D'
Revised reorder level	24,000 units	25,000 units
Average Inventory	12,000 units	12,500 units
No. of orders :		
$(1,20,000 \div 24,000)$	5	
$(2,10,000 \div 25,000)$		8
Ordering cost	Rs. 50	Rs. 80
Carrying cost	<u>4,800</u>	<u>12,500</u>
Total	4,850	12,580
Proposed as per table of EOQ for C & D	<u>980</u>	<u>2,070</u>
	<u>Rs. 3,870</u>	<u>10,510</u>

Determination of shutdown point

Problem 10-33. (a) The management of X Ltd., which is now operating at 50% capacity, expects that the volume of sales will drop below the present level of 5,000 units per month. The operating statement prepared for monthly sales shows :

Sales (5,000 units at Rs. 3 per unit)		Rs. 15,000
Less : Variable costs at Rs. 2 per unit	Rs. 10,000	
Fixed overhead	<u>Rs. 5,000</u>	
		Rs. 15,000
Net profit		<u>Nil</u>

It is proposed that the company should suspend production until market conditions improve. The General Manager estimated that a minimum of fixed costs (shut down costs) amounting to Rs. 2,000 would be necessary in any event. Advise management at what level of sales it could think of suspending production. If the sales prices decision is Rs. 2'80, what should be the sales level for shutdown.

(I.C.W.A. Final, June 1986)

Solution : Step 1. Present contribution

Sales $(5,000 \times 3)$	Rs. 15,000
Less : Variable cost	<u>Rs. 10,000</u>
Contribution	5,000

Step 2. If production is suspended, the operational loss to the company will be :

Present contribution	Rs. 5,000
Additional expenses or shutdown costs	Rs. 2,000
	<u>Rs. 7,000</u>

Step 3. Continuing the present production helps the company from incurring additional expenses of Rs. 2,000. Therefore, the company's interest to continue production will remain till something of Rs. 2,000 is recovered. Company will lose interest in the product completely, if sales volume falls so much that nothing is recovered from Rs. 2,000. Therefore, company will suspend production, when production falls by as many units as make a contribution of Rs. 2,000.

or $S \times P/V \text{ ratio} = \text{Rs. } 2,000$	
or $S = 2,000 \times 3$	or Rs. 6,000 or 2,000 units
Present level of sales (B.E. sales)	5,000 units
Less : As many units as make a contribution of Rs. 2,000, as calculated above	2,000 units
	<u>3,000 units</u>
Shutdown point	3,000 units

If selling price is reduced to Rs. 2.80

Break-even point (Revised) (Rs. $5,000 \div 0.80$)	6,250 units
Less : As many units as make a contribution of Rs. 2,000 ($2,000 \div 0.80$)	2,500 units
	<u>3,750 units</u>
Shutdown point	3,750 units

Alternatively :

Present fixed cost	Rs. 5,000
Less : Additional shutdown cost, which company will have to incur if production is suspended	Rs. 2,000
	<u>Rs. 3,000</u>
Target contribution, which must be realised, if production is not to be suspended	Rs. 3,000

Before revision of price

This target contribution is achieved at a level of :

$$S \times P/V \text{ ratio} = \text{Rs. } 3,000$$

$$S = \text{Rs. } 3,000 \times 3 = \text{Rs. } 9,000 \quad \text{or } 3,000 \text{ units}$$

\therefore Company should suspend production at a level of 3,000 unit.

After revision of prices

This target contribution is achieved at a level of

$$S \times P/V \text{ ratio} = \text{Rs. } 3,000$$

or $S = (3,000 \times 2.80) \div 0.80 = \text{Rs. } 10,500$ or 3,750 units.

Preventive maintenance vs. Breakdown maintenance

Problem 10-34. The budget estimates of a company using sophisticated high speed machines based on a normal working of 50,000 machine hours during 1986 are as under :

	<i>(Rs. lakhs)</i>
Sales (1,00,000 units)	100
	<hr/>
Raw materials	20
Direct wages	20
Factory overheads—variable	10
--fixed	10
Selling and distribution overheads—variable	5
--fixed	5
Administration overheads—fixed	10
	<hr/>
Total costs	80
	<hr/>
Profit	20

Since the demand for company's product is high, the possibilities of increasing the production are explored by the budget committee. The Technical Director stated that maintenance has not been given due importance in the budget and that if preventive maintenance is introduced, the break-down repair costs and hours lost due to break-down can be reduced and consequently production can be increased.

In support of this, he presented the following data, showing how injection of more and more funds on preventive maintenance will bring down the breakdown repair costs and reduce or eliminate the machine stoppages due to break-down :

<i>Proposed expenditure on preventive maintenance</i>	<i>Expenditure estimated to be incurred on breakdown</i>	<i>Machine hours saved</i>
Rs. 19,200	Rs. 1,92,000	Nil
36,400	1,53,600	800
76,800	1,15,200	1,600
1,53,600	76,800	2,400
3,07,200	51,600	3,200
6,14,400	—	4,000

Using the differential cost and contribution concept, advise the management up to what level breakdown hours can be reduced to increase production and maximise profits of the company consistent with minimum costs.

(C.A. Final, Nov. 1985)

Solution : Before differential cost analysis is attempted, it is necessary to work out the contribution per unit and contribution per machine hour :

(Rs. lakhs)

Selling price		100
Less : Variable costs		
Raw materials	20	
Direct wages	20	
Variable factory overheads	10	
Variable selling and distribution overheads	5	55
		<u>45</u>

1. Total contribution Rs. 45 lakhs
2. Sales volume 1,00,000 units
3. Machine hours 50,000 machine hours
4. Contribution per unit ($1 \div 2$) Rs. 45
5. Contribution per hour ($1 \div 3$) Rs. 90

It is stated by Technical Director that maintenance has not been given due importance in the budget. If preventive maintenance is introduced, the breakdown repair costs and hours lost can be reduced. It is noticed that by increasing the expenditure on maintenance, the expenditure on breakdown repairs is reduced. Therefore, differential cost on preventive maintenance has to be compared with incremental saving in machine hours saved and saving on breakdown cost.

Statement showing the differential cost and incremental saving at different levels of machine hours saved

Machine hours saved	0	500	1,600	2,400	3,200	4,000
Preventive maintenance cost	Rs 19,200	Rs 38,400	Rs 76,800	Rs 1,53,600	Rs 3,07,200	Rs 6,14,400
Differential cost on preventive maintenance (A)	—	19,200	38,400	76,800	1,53,600	3,07,200
Breakdown maint.	1,92,000	1,53,600	1,15,200	76,800	57,600	—
Differential saving on breakdown maintenance cost	—	38,400	38,400	38,400	19,200	57,600
Add : Incremental contribution due to saving in lost hours	—	*72,000	72,000	72,000	72,000	72,000

Total differential saving (B)	--	1,10,400	1,10,400	1,10,400	91,200	1,29,600
Incremental profit/loss (B - A)	—	91,200	72,000	33,600	(62,400)	(1,77,600)

It is noticed from above analysis that saving in breakdown hours can be restricted up to 2,400 hours. Beyond this, there is apparent loss. However, the company is earning the maximum incremental profit if saving in machine hours is 800 hours.

*Differential machine hours saved \times Contribution per hour
 $800 \times 90 = \text{Rs. } 72,000.$

Optimum level of holding finished stocks

Problem 10-35. v.S. Ltd., which wishes to improve its competitive position is considering to expedite its delivery time by increasing the levels of finished stocks held.

Dependent upon the degree of increase in finished stocks, it estimates that its sales now at 3,00,000 units per annum will change as follows :

*Probability of new sales at ('000) units
per annum*

If finished stocks increased by		310	320	330	340	Total
10%	0.45	0.40	0.15	—	1.00	
15%	0.30	0.45	0.25	—	1.00	
20%	0.15	0.50	0.30	0.05	1.00	
25%		0.40	0.40	0.20	1.00	

Changes resulting from increase in finished stocks would be :

(i) Extra storage accommodation would be required :

If the stocks increase up to and including 10%, construction costs of Rs. 1,80,000 and annual costs of Rs. 22,500 would be involved.

If the stocks increase above 10% the construction costs would be Rs. 4,12,500 and the annual costs Rs. 67,500.

The company treats investments of this kind as having life of seven years and requiring a 15% DCF yield,

(ii) Extra handling equipment also be required :

If the stocks increase is up to and including 15%, new equipment costing Rs. 60,000 with additional-running costs of Rs. 8,250 would be required.

If the stocks increase is above 15%, new equipment of Rs. 1,42,500 with annual costs of Rs. 11,250 would be needed.

For this type of investment, the company's criteria are 20% DCF and a life of four years.

- (iii) The present value of an annuity of Re. 1 for seven years at 15% is Rs. 4.16 and for four years at 20% is Rs. 2.59.
- (iv) Additional raw materials and work-in-progress need to be held.

	Raw materials	Work-in-progress
If finished stocks increased by		
less than 20%	15%	15%
20% or more	25%	25%

The present levels of stocks held are :

Finished stocks	Rs. 1,20,000
Raw materials	Rs. 20,000
Work-in-progress	Rs. 40,000

- (v) Extra warehouse staff would be required :

Finished stocks increase	Extra staff cost per annum
10%	Rs. 4,500
15%	Rs. 4,750
20%	Rs. 5,000
25%	Rs. 5,250

Other background information :

- The average selling price of products is Rs. 45 per unit and the variable costs are Rs. 27.00 per unit.
- Creditors for raw materials are paid 3 months after delivery.
- The company finances its entire stocks by bank overdraft at a rate of 12% p.a.
- Insurance on stocks is currently Rs. 15,000 p.a. the premium would increase proportionately for all additional stocks.

Required : Your recommendations with supporting calculations which level of holding finished stocks would be most beneficial to the company. (I.C.W.A. Final, Dec. 1986)

Suggested approach. The problem calls for the recommendations regarding level of holding finished stocks at which the company earns maximum contribution. For this purpose, following steps are called for :

- (i) Multiply probabilities to each level of sales and find out the total anticipated sales at each level of finished stocks. The anticipated sales are then multiplied with contribution per unit to find out the total contribution at different levels.
- (ii) Requirements of additional working capital are computed for the purpose of working out the requirements of additional financing charges.
- (iii) Additional costs for insurance charges, extra warehouse staff salaries, extra storage cost and extra handling charges are computed. Extra storage cost and extra handling charges

include both annual revenue cost and appropriate share of capital cost. For capital investment in the above areas, the company criteria are 15% DCF yield and life of 7 years in case of storage and 20% DCF yield and life of 4 years in case of handling. The capital investments have to be divided by the present value factors (4.16 at 15% for 7 years and 2.59 at 20% for 4 years). This will give the appropriate share of capital cost.

- (iv) Additional units at each level over and above 3,00,000 units is then multiplied by contribution per unit to find out the increase in contribution. From this all additional costs are deducted to arrive at the net increase in total contribution. The level at which the net contribution is maximum is recommended.

Solution. 1. Anticipated sales due to increase of finished stocks by applying the stated probabilities

Sales (units)	Finished stock increase by	units			
		10%	15%	20%	25%
3,10,000		1,39,500	93,000	46,500	—
3,20,000		1,28,000	1,44,000	1,60,000	1,28,000
3,30,000		49,500	82,500	99,000	1,32,000
3,40,000		—	—	17,000	68,000
Total (units)		3,17,000	3,19,500	3,22,500	3,28,000

Unit Selling price Rs. 45
Less Variable cost 27

Contribution per
unit Rs. 18

Total contribution (Rs.) 57,06,000 57,51,000 58,05,000 59,04,000

2. Additional working capital

Present levels of stock

Finished stocks (Rs. 1,20,000)	12,000	18,000	24,000	30,000
Raw materials (Rs. 20,000)	3,000	3,000	5,000	5,000
W.I.P. (Rs. 40,000)	6,000	6,000	10,000	10,000
Total working capital (Rs. 1,80,000)	21,000	27,000	39,000	45,000
Less : 25% of raw material on credit	750	750	1,250	1,250
Net additional working capital	20,250	26,250	37,750	43,750

3. <i>Addl. : financing charges @ 12%</i> (stocks financed by overdraft)	2,430	3,150	4,530	5,250
4. Insurance premium on stocks (proportionate)	$\frac{15,000}{1,80,000}$	$\frac{15,000}{1,80,000}$	$\frac{15,000}{1,80,000}$	$\frac{15,000}{1,80,000}$
	$\times 21,000$	$\times 27,000$	$\times 39,000$	$\times 45,000$
	Rs. = 1,750	= 2,250	= 3,250	= 3,750
5. Extra warehouse staff	Rs. 4,500	4,750	5,000	5,250
6. Extra storage cost				
Annual Revenue cost	22,500	67,500	67,500	67,500
Share of capital cost				
$1,80,000 \div 4.16$ P.V. factor	43,269	—	—	—
$4,12,500 \div 4.16$ P.V.	—	99,159	99,159	99,159
7. Extra handling cost				
Annual revenue cost	8,250	8,250	11,250	11,250
Proportionate capital cost				
$60,000 \div 2.59$	23,166	23,166	—	—
$1,42,500 \div 2.59$	—	—	55,019	55,019
Total additional cost (col 3 to 7)	1,05,805	2,08,225	2,45,708	2,47,178
8. Additional units over 3,00,000 units	17,000	19,500	22,500	28,000
9. Increase in contribution Rs. 18 \times Col. 8	3,06,000	3,51,000	4,05,000	5,04,000
10. Net increase in contribution (col. 9 less col. 7)	2,00,135	1,42,775	1,59,292	2,56,822

The above computations show that the contribution is maximum Rs. 2,56,822 at 25% increase in finished stocks and the same should be accepted if followed by 10% increase in finished stocks.

Closing down a department

Problem 10-36 (Adding a further product—Relevant Cost). Tiptop Textiles manufactures a wide range of fashion fabrics. The company is considering whether to add a further product the "Superb" to the range. A market research survey recently undertaken at a cost of Rs. 50,000 suggests that demand for the "Superb" will last for only one year, during which 50,000 units could be sold at Rs. 18 per unit. Production and Sale of "Superb" would take place evenly throughout the year. The following information is available regarding the cost of manufacturing "Superb":

Raw Materials : Each "Superb" would require 3 types of raw materials Posh, Flash and Splash. Quantities required, current stock levels and costs of each raw material are shown below. Posh is used regularly by the company and stocks are replaced as they are used. The current

stock of Flash is the result of overbuying for an earlier contract. The material is not used regularly by Tiptop Textiles and any stock that was not used to manufacture "Superb" would be sold. The company does not carry a stock of Splash and the units required would be specially purchased.

Raw Material	Quantity reqd. per unit of Superb (metres)	Current stock level (metres)	Costs per metre of raw material Original cost Rs.	Current replacement cost Rs.	Current resale value Rs.
Posh	1.00	1,00,000	2.10	2.50	1.80
Flash	2.00	60,000	3.30	2.80	1.10
Splash	0.50	0		5.50	5.00

Labour: Production of each "Superb" would require a quarter of an hour of skilled labour and two hours of unskilled labour. Current wage rates are Rs. 3 per hour for skilled labour and Rs. 2 per hour for unskilled labour. In addition, one foreman would be required to devote all his working time for one year in supervision of the production of Superb. He is currently paid an annual salary of Rs. 15,000. Tiptop Textiles is currently finding it very difficult to get skilled labour. The skilled workers needed to manufacture "Superb" would be transferred from another job on which they are earning a contribution surplus of Rs. 1.50 per labour hour, comprising sales revenue of Rs. 10.00 less skilled labour wages of Rs. 3.00 and other variable costs of Rs. 5.50. It would not be possible to employ additional skilled labour during the coming year. If "Superb" are not manufactured, the company expects to have available 2,00,000 surplus unskilled labour hours during the coming year. Because the company intends to expand in the future, it has decided not to terminate the services of any unskilled worker in the foreseeable future. The foreman is due to retire immediately on an annual pension payable by the company of Rs. 6,000. He has been prevailed upon to stay on for a further year and to defer his pension for one year in return for his annual salary.

Machinery: Two Machines would be required to manufacture "Superb" MT 4 and MT 7. Details of each machine are as under:

	Start of the year	End of the year
MT 4	Rs.	Rs.
Replacement Cost	80,000	65,000
Resale Value	60,000	47,000
MT 7		
Replacement Cost	13,000	9,000
Resale Value	11,000	8,000

Straightline depreciation has been charged on each machine for each year of its life. Tiptop Textile owns a number of MT 4 machines,

soon it reaches the end of its useful life. MT 7 machines are no longer used and the one which would be used for "Superb" is the only one the company now has. If it was not used to produce "Superb", it would be sold immediately.

Overheads : A predetermined rate of recovery for overheads is in operation and the fixed overheads are recovered fully from the regular production at Rs. 3.50 per labour hour. Variable overhead costs for Superb are estimated at Rs. 1.20 per unit produced.

For decision-making, incremental costs based on relevant costs and opportunity costs are usually computed.

You are required to compute such a cost sheet for "Superb" with all details of material, labour, overhead etc., substantiating the figures with necessary explanations. (C.A. Final, November 1987)

Solution. Working Note. First each relevant cost will be discussed and then cost sheet will be prepared.

- (i) Market Survey cost of Rs. 50,000 is sunk cost and hence it is irrelevant to decision.
- (ii) Raw Material Posh is regularly used and stocks are replaced as they are used. Hence current replacement cost is relevant
 $50,000 \text{ units} \times \text{Rs. } 2.50 = \text{Rs. } 1,25,000.$
- (iii) Current stock of Flash is result of overbuying. Quantity already available is 60,000 metres. This should be charged to Superb at current resale value of Rs. 1.10. Balance requirement is to be charged at current replacement cost.

Flash

Current Stock	60,000 metres \times Rs. 1.10 =	Rs. 66,000
Balance Stock reqd.	40,000* metres \times Rs. 2.80 =	1,12,000
		<hr/> 1,78,000 <hr/>

*Total requirement = 50,000 units \times 2 units = 1,00,000 units

Less : Current stock level = 60,000 units

Balance stock required. 40,000 units

(iv) Splash is to be purchased.

$50,000 \text{ units} \times 0.5 \text{ meter} \times \text{Replacement Cost of Rs. } 5.50$
 $= \text{Rs. } 1,37,500$

Labour :

(v) To manufacture 50,000 units of Superb, skilled labour hours required = $50,000 \times \frac{1}{4} = 12,500$ hours

Unskilled labour hours required = $50,000 \times 2 = 1,00,000$ hours

DECISION MAKING**P10-79**

Cost of deployment = 12,500 hours × Rs. 3	= Rs. 37,500
Opportunity Cost* = 12,500 hours × Rs. 1.50	= 18,750
	<u>56,250</u>

*If Superb had not been manufactured and skilled labour had not been deployed, it would have given a contribution of Rs. 1.50 per hour. This is the opportunity cost for producing Superb.

Unskilled Labour. No work has suffered. No extra cost is involved. Perhaps they are kept with the assurance of getting them a job after preliminary training. Cost is Nil.

Foreman :

Annual Salary :-	Rs. 15,000
Less : Pension saved* =	<u>6,000</u>

Effective cost 9,000

*Pension is committed cost irrelevant to decision.

(vi) Machinery :

MT 4 are used and replaced regularly. Therefore, difference of replacement cost between start and the end is relevant. Cost of using MT 4 = Rs. 80,000 — Rs. 65,000 = Rs. 15,000.

MT 7 is not in use.

Rs. 11,000 — 8,000 = Rs. 3,000.

(vii) Overhead :

Fixed overheads have been recovered fully. It is therefore irrelevant to this decision. Variable overheads = 50,000 × Rs. 1.20 = Rs. 60,000.

Cost sheet for 50,000 units of "Superb"**Raw Materials :**

Posh	Rs. 1,25,000	Rs.
Flash	1,78,000	
Splash	<u>1,37,500</u>	4,40,500

Labour :

Skilled	Rs. 56,250	
Unskilled	Nil	
Foreman	<u>9,000</u>	65,250

Machinery Cost :

MT 4	Rs. 15,000	18,000
MT 7	<u>3,000</u>	60,000

Variable Overheads 5,83,750

Profit 3,16,250

Sales Revenue (50,000 × Rs. 18) 9,00,000

Problem 10-37 (Evaluation of Impact of Strike). (a) A company manufacturing agricultural machinery is faced with the possibility of a strike by direct production workers engaged on the assembly of one of its machines.

The trade union is demanding an increase of 7%, back-dated to the beginning of its financial year (1 January), but the company expects that

if a strike does take place, it will last four weeks after which the union will settle for an increase of 5% similarly back-dated.

The machine whose production would be affected by the strike is sold to distributors at a discount of 20% from the current recommended selling price of Rs. 3,000.

Estimated costs for the machines are :

	<i>Fixed per year</i>	<i>Variable per machine</i>
	Rs. '000	Rs.
Production	16,000	1,800
Distribution	1,000	100

Direct labour costs comprise 40% of the variable production costs.

The budgeted output is 27,500 machines in 50 working weeks per year.

If the strike takes place, the following events are expected by the company :

—Maintenance staff, whose wages are included in the fixed production costs, would be used to carry out an overhaul of the conveyor system using Rs. 25,000 worth of materials. This overhaul would otherwise be undertaken by an outside contractor at a cost of Rs. 1,00,000 including materials.

—Sales of 650 machines would be lost to competition. The balance that would ordinarily have been produced during the strike period could, however, be sold, but these machines would have to be made up in overtime working which would be at an efficiency rate of 90% of normal. This would entail additional fixed costs of Rs. 10,000 and wage payments at time and one-half.

You are required to state, with explanations and full supporting data, whether from a purely economic point of view you would advise the management to allow the strike to go ahead, rather than agree to the union's demand.

(b) Assume that the strike goes ahead, and that it lasts three weeks, after which agreement is reached between the company and the union for a 6% pay increase back-dated to 1st January. Assume also that the anticipated loss of sales to competitors of 650 machines occurs and the balance is made up by overtime working.

A newspaper reports that the cost of the strike to the company was Rs. 5 million. The trade union counters this claim by insisting that the strike was contrived by the company, to its benefit, as the machines were selling at a loss.

You are required to : (i) comment on the statements made by the press and the trade union ;

(ii) state, with supporting calculations, whether the company was justified in using overtime working to produce the balance of machines saleable but not produced during the strike. (C.I.M.A. London, May 1987)

Solution.

Necessary Workings :

Selling price	Rs. 3,000
Less : 20% discount	600
	<hr/> 2,400

Less : Variable costs :

Production	1,800	
Distribution	100	1,900
	<hr/>	<hr/>
Contribution		500

or Budgeted output = 27,500 units per year
 $27,500 \div 50 \text{ weeks} = 550 \text{ per week}$
 Direct labour = 40% of Production costs of Rs. 1,800
 = Rs. 720 per unit

With 7% increase, revised labour cost will be
 = Rs. 720 + Rs. 50.4 = Rs. 770.4

With 5% increase, revised labour cost will be
 Rs. 720 + Rs. 36 = Rs. 756.

(a) (i) Evaluation of two situations :

Alternative 1 with no strike :

Cost of settlement is 7% increase, i.e., Rs. 50.4 per unit

∴ Annual cost of settlement = 27,500 units × Rs. 50.4

= Rs. 13,86,000

(A)

Alternative 2, i.e., if strike goes ahead :

Extra costs will be

(i) 5% increase in labour cost will be Rs. 36

Annual incremental labour cost

= [27,500 units - (4 weeks × 550 units per week)] Rs. 36

= Rs. 9,10,800

(ii) Loss of contribution due to loss of sales to

competitors (650 × Rs. 500) =

Rs. 3,25,000

(iii) Overtime will have to be paid for

2,200 units - 650 units = 1,550 units

Premium* = 1,550 units × Rs. 756 × 0.50

5,85,900

Efficiency* = 1,550 units × Rs. 756 × 1.50 × 1/9

1,95,300

(iv) Additional fixed cost

Rs. 10,000

20,27,000

Gain on maintenance work

(Rs. 1,00,000 - Rs. 25,000)

75,000

Differential Cost, if strike goes ahead

19,52,000 (B)

If there is no strike, it will yield a financial advantage of Rs. 5,66,000

Recommendation. From a purely economic point of view, management should accept union's demand.

*Note. For 1,550 units 50% of normal rate will be paid and an amount of Rs. 1,95,300 will have to be paid for low efficiency. Please note that incremental payments are to be considered

(a) (ii) Three factors, not considered in above evaluation, that may have adverse effects, if the strike were to take place are :

—There will be a 'knock on' effect of wage increase and all other workers will start demanding it.

—Customers gone to competitors may not even return.

— Loss of sale will have adverse effect on sale of spare parts.

(b) (i) The newspaper report has over stated that cost of strike will be Rs. 5 million. The reporter of press appears to have multiplied the selling price of Rs. 3,000 by 550 machines per week for 3 weeks. It comes to Rs. 4.95 million. This is wrong approach.

(ii) Profitability of over time working

Contribution per machine as per forecast		Rs. 500
Extra Costs :		
Premium (Rs. 720×0.50)=	Rs. = 360	
Efficiency (Rs. $720 \times 1.50 \times 1/9$)	= 120	
Wage increase=6% ($720 + 360 + 120$)	= 72	
Additional=Rs. $10,000 \div 1,000$	= 10	562
Loss on each machine		<u>62</u>

From financial point of view, company is not justified in opting for overtime working. This decision might have been taken due to relations with customers.

Sell the product after restyling or sell as reject (Relevant Costs)

Problem 10'38. Fashion Galore manufactures ladies' wear. It planned to sell maxi skirts in one year at a price of Rs. 100 each, the cost of which is Rs. 60 each. During the year, out of the manufactured 10,000 skirts only 6,000 were sold. Fashion has now changed and so it is not possible to sell the remaining stock. The Sales Manager finds two alternative courses of action. The skirts can be restyled as Miniskirts or they can be sold as rejects. Cost of restyling will be Rs. 2,00,000 and it is forecast that the Miniskirt can be sold for Rs. 80 each while the scrap value of the offcuts will be Rs. 30,000. If the company decides to sell the stock as rejects, the resulting proceeds will be Rs. 80,000.

What will be your advice to the States Manager ?

(I.C.W.A. Final, June 1985)

Solution. In this problem, it is necessary to find out the relevant costs and relevant benefits. Irrelevant costs and benefits are not to be considered for decision-making. Out of 10,000 skirts, only 6,000 were sold during the year at a price of Rs. 100 each. All this information is irrelevant for the present decision except 4,000 unsold skirts. The relevant cost and benefit analysis is given below :

Sale of miniskirts ($4,000 \times \text{Rs. } 80$)	Rs. 3,20,000
Add : Scrap value of offcuts	30,000
Total sales realisation	<u>3,50,000</u>
Less : Cost of restyling	<u>2,00,000</u>
Net profit	<u>1,50,000</u>
Sales proceeds from rejects	80,000

It is profitable to sell as miniskirts rather than rejects.

MARKETING DECISIONS

Selling part production as seconds

Problem 10-39. Fashion Creations Company manufactures and sells socks. Productive capacity is 50 lakh pairs per year. All pairs are subjected to rigorous inspection. Because of flaws 20% of the output is invariably rejected and must be sold as seconds. The remaining 80% of the output is sold under the brand name "Cosy Comfort," for Rs. 4.00 per pair. The seconds are presently being sold under the brand name "Cosy seconds" for Rs. 2.40 per pair.

The following is budgeted for 1984-85 proposed sale :

Cosy Comfort	35 lakh pairs
Cosy seconds	8.75 lakh pairs
Variable production costs	Rs. 1.20 per pair produced
Fixed production cost	Rs. 44 lakhs
Variable selling expenses	Rs. 0.20 per pair sold
Fixed selling expenses	Rs. 30 lakhs

A consultant has advised the management that the sales of seconds under the cosy brand name are affecting the sales of Cosy Comfort. He has estimated that sales volume of Cosy Comfort could be increased by 20% in 1984-85, if sales of second under the company's brand name were discontinued. There is a possibility that the entire output of seconds could be sold to a chain department store with no brand identification for Rs. 1.40 per pair. The usual variable selling expenses on these sales would be avoided but additional despatch and invoicing costs of Rs. 40,000 per year would be incurred. There was no significant opening or closing inventories. Compute the effect of the proposals and advise management suitably. (I.C.W.A. Final, June 1984)

Solution : Budgeted Profit

Cosy comfort 35 lakhs (Rs. 4—Rs. 1.40)	Rs. 91.00 lakhs
Cosy seconds 8.75 lakhs (Rs. 2.40—Rs. 1.40)	8.75 lakhs
Contribution	99.75 lakhs
Fixed production costs and selling expenses	74.00 lakhs
Estimated income	25.75

The consultant's estimate of 20% increase in volume is not attainable due to capacity constraint. As per suggestion, Cosy Comfort can go up to (120% of 35) 42 lakh pair. If 42 lakh pair of Cosy Comforts are produced, 10.5 lakhs of Cosys Seconds will have to be produced and the total output will be 52.5. But, the maximum capacity is 50 lakh pairs. Therefore, at the most 40 lakh pairs of Cosy Comforts can be produced and relevant analysis for the same is given below :

Incremental Revenue**Cosy Comfort**

$$(40 \text{ lakhs} - 35 \text{ lakhs}) \times (\text{Rs. } 4.00 - \text{Rs. } 1.40)$$

Rs. 13 lakhs

Cosy Seconds

Profit resulting from sale of Cosy seconds to chain store without brand name

10 lakhs (Rs. 1'40—Rs. 1'20=Re. 0'20*)	=	2 lakhs
		<u>15 lakhs</u>

*Rs. 1'40—Rs. 0'20 = Rs. 1'20.

Less : (i) Profit forgone on sale of second

8'75 lakhs (Rs. 2'40—Rs. 1'40)	Rs. 8'75 lakh	
(ii) Additional dispatch and invoicing costs	0'40 lakhs	9'15 lakhs
	<u> </u>	<u> </u>
Incremental profit due to this proposal		5'85
		<u> </u>

∴ Proposal can be accepted.

Alternative marketing outlet

Problem 10 40. Goodmorning Products market corn flakes for the breakfast table under the brand name CRISPO. The Budgeted Revenue Account and Net Assets for the next year is prepared as under :

Budgeted Revenue Account

	Rs.	Rs.
Sales (20,000 boxes containing 10 standard packets)		6,00,000
Direct materials	2,40,000	
Direct labour	1,02,000	
Variable overhead	70,000	
Fixed overhead	1,22,000	5,34,000
	<u> </u>	<u> </u>
Profit		66,000
		<u> </u>

Budgeted Net Assets

	Rs	Rs
Fixed assets (net of depreciation)		3,10,000
Working capital :		
Debtors	50,000	
Stocks	65,000	
Creditors	(25,000)	90,000
	<u> </u>	<u> </u>
Net assets employed		4,00,000
		<u> </u>

The existing plant and equipment is considerably under utilised and a proposal is being considered to extend sales to supermarkets where the product would be sold under a different brand name CRUNCHU.

The effects of this proposal have been estimated and are submitted as under :

- (i) Additional annual sales to supermarkets 8,000 boxes at Rs. 24 per box of 10 standard packets.

- (ii) Cost of Direct Materials will be reduced as a result of a 5% bulk discount on all purchases.
- (iii) Excise supervisory and administrative personnel will be required at a cost of Rs. 16,000 per annum.
- (iv) Market survey has indicated that sales to existing outlets will fall by approximately 10% and there will be no change in selling price to these customers.
- (v) Stock and creditors will increase by Rs. 25,000 and Rs. 15,000 respectively and the credit period extended to supermarkets will be double than that given to existing customers.

You are required to prepare a revised budgeted revenue account and statement of net assets employed incorporating the results of the proposal and advise the management on the suitability of the proposal by computing and comparing the revised profit on sales and return on capital employed with the corresponding figures before the revision.

(I.C.W.A. Final, Dec. 1983)

Solution :

	Existing plan	Revised proposal
Variable cost per box		
Direct material	Rs. 12.00	Rs. 11.40 (Cost of D.M. less 5%)
Direct labour	5.10	5.10
Variable overhead	3.50	3.50
	<u>20.60</u>	<u>20.00</u>

For finding out the revised profitability, it is necessary to work out the following :

	Revised
Sales [18,000 (existing sale less by 10%) @ Rs. 30 + 8,000 boxes @ Rs. 24]	Rs. 7,32,000
Variable cost (26,000 boxes @ Rs. 20)	5,20,000
Fixed overhead (Existing Rs. 1,22,000 + additional Rs. 16,000)	1,38,000
Stock (existing Rs. 65,000 + additional Rs. 25,000)	90,000
Creditors (Rs. 25,000 + additional Rs. 15,000)	40,000
Debtors [one month sale to usual customers, i.e., $(18,000 \times 30) \times 1/12$ = Rs. 45,000]	
Two months' sale on supermarket $[(8,000 \times 24) \times 2/12 = 32,000]$	77,000

Statement showing the comparative budgeted revenue account

	Existing	Proposed
Sales	Rs. 6,00,000	Rs. 7,32,000
Less : Variable cost	4,12,000	5,20,000

Contribution	1,88,000	2,12,000
Less : Fixed cost	1,22,000	1,38,000
	<hr/>	<hr/>
Net profit	66,000	74,000
	<hr/>	<hr/>
Net profit as % of sales	11%	10·11%

The net profit as % of sales has come down by 0·89% by revised proposal.

Statement showing the comparative net assets employed

	<i>Existing</i>	<i>Proposed</i>
	Rs. 3,10,000	Rs. 3,10,000
Fixed assets		
<i>Add : Net working capital :</i>		
Debtors	50,000	77,000
Stocks	65,000	90,000
Creditors	(25,000)	(40,000)
	<hr/>	<hr/>
Net assets employed	4,00,000	4,37,000
	<hr/>	<hr/>
Net profit	66,000	74,000
	<hr/>	<hr/>
Return on investment	16·5%	16·93%
	<hr/>	<hr/>

The revised proposal slightly improves the return on investment. The company should reduce the cost so that revised proposal becomes more viable.

Selling agents vs. own sales force

Problem 10 41. Zed Ltd., manufactures a range of products which it sells through manufacture's agents to whom it pays commission of 20% of the selling price of the products. Its budgeted profits and loss statement for 1987 is as follows :

Sales		Rs. 22,50,000
Production costs :		
Prime costs and variable overhead	Rs. 7,87,500	
Fixed overhead	3,62,500	11,50,000
		<hr/>
Selling costs :		11,00,000
Commission to manufacturer's agents	4,50,000	
Sales office expenses (fixed)	20,000	4,70,000
		<hr/>
		6,30,000
Administration costs (fixed)		3,00,000
		<hr/>
Profit		Rs. 3,30,000
		<hr/>

Subsequent to the preparation of the above budgeted profit and loss statement, the company is faced with a demand from its agents for an increase in their commission to 22% of selling price. As a result, the company is considering whether it might achieve more favourable results if it were to discontinue the use of manufacturers' agents and, instead employ its own sales force. The costs that this could involve are budgeted as follows :

Sales manager (salary and expenses)	Rs. 75,000
Salesmen's expenses (including travelling costs)	20,000
Sales office costs (additional to present costs)	50,000
Interest and depreciation on sales department cars	35,000

In addition to the above, it will be necessary to hire four salesmen at a salary of Rs. 40,000 per annum each plus commission of 5% on sales plus car allowance of Re. 1 per kilometre to cover all costs except interest and depreciation.

On the assumption that the company decides to employ its own sales force on the above terms, you are required to ascertain :

(a) What is the maximum average kilometre per annum that salesmen could travel if the company is to achieve the same budgeted profit as it would have obtained by retaining the manufacturer's agents and granting them the increased commission they had requested. Assume that sales in each case would be as budgeted.

(b) At what level of sales would the original budgeted profit be achieved if each salesman were to travel an average of 14,000 kilometres per annum. Assume that all other assumptions inherent in the budgets were maintained.

(c) What is the maximum level of commission on sales that the company could afford to pay if it wished to achieve a 16% increase in its original budgeted profit and expected a 16% increase in sales (at budgeted selling prices) and average of 16,000 kilometres per annum to be travelled by each salesman. (Calculate your answer to one decimal place.)

(C.A. Final, Nov. 1986 ; I.C.W.A. (F.), June 1985)

Solution : (a) Economics of the proposal if the company employs its own sales force

Savings due to discontinuance of agents

Existing commission (20%)	Rs. 4,50,000
Add : Additional 2% on sales	45,000
	<hr/>
Total savings in commission (i)	4,95,000
	<hr/>

Additional cost (excluding car allowance) due to own sales force

Sales manager (salary and expenses)	Rs. 75,000
Salesmen's expenses	20,000
Additional sales office costs	50,000

Interest and depreciation on sales department cars	35,000
Salaries of four salesmen	1,60,000
Commission to salesmen (5% of Rs. 22,50,000)	1,12,500
	<hr/>
Total additional costs (ii)	4,52,500
	<hr/>
Net savings before car allowance (i)—(ii)	42,500
	<hr/>

The company has to achieve the same budgeted profit as it would have obtained by retaining the agents (with 22% commission). Therefore, total car allowance would work out to Rs. 42,500. The rate of car allowance is Re. 1 per kilometre. Thus, the total kilometres travelled will be 42,500 for all the four salesmen or 10,625 kilometres per salesman.

(b) Existing P/V ratio

Budgeted sales		Rs. 22,50,000
Less : Variable costs	7,87,500	
Commission (5%)	1,12,500	9,00,000
	<hr/>	<hr/>
		13,50,000
		<hr/>

$$\text{P/V ratio} : 13,50,000 \div 22,50,000 \times 100 = 60\%$$

Desired contribution

Fixed costs :

Fixed overheads	Rs. 3,62,500
Sales office expenses	20,000
Administration costs	3,00,000
Sales manager's salary and expenses	75,000
Salesmen's expenses	20,000
Additional sales office costs	50,000
Interest and depreciation	35,000
Salaries of four salesmen	1,60,000
Car allowance (14,000 km. \times 4 \times Re. 1)	56,000
	<hr/>

Total fixed costs	10,78,500
Budgeted profit	3,30,000
	<hr/>
Desired contribution	14,08,500

Sales \times P/V ratio = Contribution

$$\text{Sales} = 14,08,500 \times \frac{100}{60} \quad \text{or Rs. 23,47,500}$$

(c) Maximum level of commission on sales with anticipated increase in profit and sales

$$\text{Variability ratio} = \frac{\text{Budgeted variable cost}}{\text{Budgeted sales}} \times 100$$

$$= \frac{\text{Rs. } 7,87,500}{\text{Rs. } 22,50,000} \times 100 \quad \text{or } 35\%$$

Budgeted sales = Rs. 22,50,000 Desired increase = 16%

Revised sales = Rs. 26,10,000

Variable cost (35% of sales) Rs. 9,13,500

Contribution 16,96,500

Less : Fixed cost (excluding car allowance) 10,22,500

Car allowance (64,000 km. \times Re. 1) 64,000 10,86,500

Net profit available 6,10,000

Less : Desired profit (16% increase over Rs. 3,30,000) 3,82,800

Amount available for commission 2,27,200

$$\text{Maximum level of commission} = \frac{2,27,200}{26,10,000} \times 100 = 8.7\%$$

Incremental contribution by spending on advertisement

• **Problem 10-42.** Devi and Company has made the following estimates in respect of incremental sales against three product lines, that can be realised for each advertising rupee spent :

*Incremental rupee sales for each
rupee spent on advertisement*

Line A	Rs. 6
Line B	Rs. 12
Line C	Rs. 10

The following figures are available about the average performance of the three product lines over the past several years.

		Line A	Line B	Line C
Sales	(Rs.)	3,00,000	1,80,000	2,50,000
Variable expenses	(Rs.)	1,80,000	1,35,000	2,05,000

You are requested to recommend (by showing the profit volume ratios and incremental contribution the product line on which the company should concentrate its advertising programme, if Rs. 5,000 is available for advertisement in a year. There is no change in fixed costs.

(I.C.W.A. Inter, Dec. 1984)

Solution : Statement showing P/V ratios of each product line

	Line A	Line B	Line C
Sales (Rs.)	3,00,000	1,80,000	2,50,000
Variable expenses	1,80,000	1,35,000	2,05,000
Contribution	1,20,000	45,000	45,000
P/V Ratio	40%	25%	18%

If only P/V ratio is to be considered, Line *A* should be preferred. But P/V ratio should be considered along with incremental contribution from each product-line.

Statement showing the incremental revenue in conjunction with P/V Ratio

Product Line	Incremental sales per rupee spent on advertisement	Total amount available for advertisement	Total incremental sales (2 × 3)	P/V Ratio	Total incremental contribution (4 × 5)
1	2	3	4	5	6
Line <i>A</i>	Rs. 6	Rs. 5,000	Rs. 30,000	40%	Rs. 12,000
Line <i>B</i>	12	5,000	60,000	25%	15,000
Line <i>C</i>	10	5,000	50,000	18%	9,000

As product line *B* is yielding maximum incremental contribution, the company should spend on advertisement of this product-line only.

Measurement of performance of sales representatives

Problem 10'43. A manufacturing company has appointed five zonal sales representatives to boost the sales of their range of products. Each sales representative is in charge of the sales of a territory allotted to him. They have been provided with a price list which is valid for a year but they have also been authorised to increase or decrease the prices within a certain range irrespective of the territory, in the overall interests of quick disposal of the company's products. The increases or decreases in prices are done by them by levying surcharge or by allowing discount.

In order to monitor their performance, sales quotas are fixed for each quarter of the year for each sales representative and a commission of 4% is given on the orders actually booked in addition to a monthly salary. The quantum of commission earned serves as an indicator of efforts made by the sales representatives. You have been furnished with the following information for making an appraisal of the performance of the sales representatives during the quarter ended September, 1985 :

	Sales Representatives				
	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>
	Rs.	Rs.	Rs.	Rs.	Rs.
(a) Standard cost of quota sales	5,41,000	4,90,000	5,26,000	4,60,000	5,00,000
(b) Contributory margin mix variance	15,000A	21,000A	63,000A	27,000A	15,000F
(c) Selling price variance	11,500A	90,000A	30,000A	40,500F	45,000F

(d) Sales volume variance	16,000A	15,000A	2,40,000F	29,250A	12,500A
(e) Commission earned	35,700	24,800	44,800	31,650	36,500

(i) Prepare a statement showing the sales quota fixed for each sales representative and the actual contribution made by each of them.

(ii) The management is considering a proposal to offer a reward to the best two performances achieved by the sales representatives. Discuss what are the bases available to you to rank the performance of sales representatives for this purpose and state with reasons the basis you will adopt.

(iii) Rank the sales representatives on the basis chosen by you in (ii) above. (I.C.W.A., Final, December 1985)

Solution :

(i) Statement showing the sales quota fixed for each sales representative and contribution made by each of them

Details	Sales Representative				
	A	B	C	D	E
Commission earned (given @ 4% of orders actually booked) (Rs.)	35,700	24,800	44,800	31,650	36,500
Orders actually booked (commis- sion ÷ 4%)	8,92,500	6,20,000	11,20,000	7,91,250	9,12,500
Sales price variance	11,500A	90,000A	30,000A	40,500F	45,000F
Sales volume vari- ance	16,000A	15,000A	2,40,000F	29,250A	12,500A
Sales quota fixed	9,20,000	7,25,000	9,10,000	7,80,000	8,80,000
Less : Standard cost of quota sales	5,11,000	4,90,000	5,26,000	4,60,000	5,00,000
Standard contri- bution	3,79,000	2,35,000	3,84,000	3,20,000	3,80,000
Contributory mar- gin mix variance	15,000A	21,000A	63,000A	27,000A	15,000F
Selling price variance	11,500A	90,000A	30,000A	40,500F	45,000F
Actual contribution made	3,52,500	1,24,000	2,91,000	3,33,500	4,40,000

Note : (1) For finding out the sales quota, adverse sales price and sales volume variances are added and such favourable variances are deducted from orders actually booked.

(2) Conversely for determining actual contribution, adverse margin mix variances and selling price variances are added and such favourable variances are deducted from standard contribution.

(3) Sales price variances have impact on actual sales and actual contribution. Therefore, sales price variances have been included under both headings (ii) and (iii) Actual contribution made by each sales representative is the objective basis to rank the performance of sales representatives. The ranking of each representative is as under :

<i>Sales representative</i>	<i>Rank</i>
<i>E</i>	<i>I</i>
<i>A</i>	<i>II</i>
<i>D</i>	<i>III</i>
<i>C</i>	<i>IV</i>
<i>B</i>	<i>V</i>

The company has appointed five zonal sales representatives to boost the sales of their range of products. The quantum of commission earned may serve as an indicator of efforts made by the sales representative in case of single product only. But, in this case, sales representatives are handling a range of products. Therefore, sales-mix and contribution are deciding factors for measuring their efficiency. In the above statement it is seen that sales representative *C* has booked the maximum orders and consequently earned the maximum commission as compared to others and, therefore, there is favourable volume variance. This means that he had sold larger quantity at lower prices thereby causing lower contribution.

In the present case, sales representative *E* has been adjudged best on the basis of sales-mix and resultant contribution. This can be the only correct measure of determining efficiency of sales representatives in a multi-product sales.

Selection of supplier and customer

Problem 10-44. Carryon Limited produces a chemical product which is processed through two departments, P_1 and P_2 . The Company has the capacity to process an input of 5,000 tonnes in the coming year. Normal waste in department P_1 is 5 per cent of input and in department P_2 , 10 per cent of input to that department. Waste from department P_1 is sold at Rs. 10 per tonne, and P_2 waste at Rs. 12 per tonne, the sales value being credited against the costs of departments. Budgeted departmental costs for the coming year are :

	<i>Dept. P_1</i>	<i>Dept. P_2</i>
Direct labour	Rs. 50,000	Rs. 45,000
Overheads	42,000	38,000

The Company has three possible sources of supply for its raw materials :

Supplier *A* offers to supply up to 3,000 tonnes at a price of Rs. 10 per tonne ;

Supplier *B* will supply the 5,000 tonnes required at Rs. 12 per tonne with discount of 10 per cent if the company buys the whole of its requirement from them ; and

Supplier *C* can supply up to 4,000 tonnes at a price of Rs. 11'30 per tonne.

In each case Carryon Limited must collect the raw materials from the supplier. Transport costs vary with the distance involved. Variable costs would be :

Supplier <i>A</i>	Rs. 0'60 per tonne
Supplier <i>B</i>	Rs. 0'40 per tonne
Supplier <i>C</i>	Rs. 0'50 per tonne

Fixed transport costs would be Rs. 10,000 per annum whichever supplier is used.

The finished output from department *P2* can be sold to three possible customers :

Customer *X* will purchase up to 2,000 tonnes at a price of Rs. 65 per tonne.

Customer *Y* will purchase up to 4,000 tonnes at Rs 65 per tonne. but requires a trade discount of 10 per cent.

Customer *Z* will purchase the whole of the output but will only pay Rs. 57'50 per tonne. This customer will collect the finished output from Carryon Limited.

Delivery costs to customer *X* and *Y* are
Variable costs :

Customer <i>X</i>	Rs. 0'70 per tonne
<i>Y</i>	Rs. 0'60 per tonne

Fixed costs : Rs. 9,000 for the year.

Required : Prepare a report making recommendations on the choice of suppliers and customers if profit is to be maximised. Support your recommendations with suitable statements showing the departmental and overall results if your recommendations are adopted.

(I.C.W.A. Final, Dec. 1985)

Solution. In this problem, the most profitable alternatives will be selected. The following three problems have to be tackled :

- Choice of a supplier which is cheapest ;
- Choice of a customer which offers maximum price ; and

(c) Department profitability and overall profitability by accepting the best choices.

(a) **Choice of supplier.** The company has a capacity to process an input of 5,000 tonnes. So the maximum quantity of raw material to be purchased is 5,000 tonnes.

	Suppliers			
	A	B	C	
Quantity purchased : up to 3,000 tonnes		less than 5,000 tonnes	5,000 tonnes	up to 4,000 tonnes.
Rate per tonne	Rs. 10.00	Rs. 12.00	Rs. 10.80	Rs. 11.30
Variable transport cost	0.60	0.40	0.40	0.50
Total cost	10.60	12.40	11.20	11.80

Supplier A is the cheapest and therefore, 3,000 tonnes should be purchased from A. The remaining 2,000 tonnes should be purchased for C at a price of Rs. 11.80 per tonne. The total cost will be $(3,000 \times 10.60 + 2,000 \times 11.80) = \text{Rs. } 55,400$. If the entire quantity is purchased from B @ Rs. 11.20 the total cost will be Rs. 56,000. Therefore, material should be purchased from A and C.

(b) **Choice of customer**

	Customers		
	X	Y	Z
Quantity sold	up to 2,000 tonnes	3,000 tonnes	4,275* tonnes
Price per tonnes (Rs.)	Rs. 65.00	Rs. 57.00	Rs. 57.50
Less : 10% discount		6.50	
		58.50	
Less : Distribution cost	0.70	0.60	—
	64.30	57.90	57.50

*5,000 tonnes of input less 10% waste in Department $P_1 = 4,750$ tonnes less 10% loss in Department $P_2 = 4,275$ tonnes.

Customer X is offering the highest price and as such 2,000 tonnes of output should be sold to X. Customer Z offers the next best price. But entire output of 4,275 will have to be sold to Z. Therefore, choice will lie in the following alternatives :

(i) Sell entire output of 4,275 tonnes to Z.

(ii) Sell 2,000 tonnes to X, and 2,275 tonnes to Y.

The comparative profitability of these customers will be as under :

(i) Sale to Z 4,275 tonnes @ Rs. 57.50	=Rs. 2,45,812.50
Fixed cost and variable delivery cost	Nil
Net sales	2,45,812.50
(ii) Sale to X—2,000 tonnes @ Rs. 64.30	1,28,600.00
Sales to Y—2,275 tonnes @ Rs. 57.90	1,31,722.50
Total sales	2,60,322.50
Less : Fixed cost of delivery	9,000.00
	2,51,322.50

The sales value will be maximum if the product is sold to both X and Y.

(c) Departmental profitability and overall profitability

Department P ₁	Quantity	Rate	Total
Supply from A	3,000 tonnes	Rs. 10.60	Rs. 31,800
Supply from C	2,000 tonnes	11.80	23,600
Direct labour			50,000
Fixed transport cost			10,000
Other overheads			42,000
Total	5,000 tonnes		1,57,400
Less : 5% wastage sold @ Rs. 10	250		2,500
	4,750		1,54,900

Note : The product is processed through two departments P₁ and P₂, output of one department is transferred to the next department. Therefore, in the above situation, output of 4,750 tonnes of department P₁ will be transferred to department P₂.

Department P ₂	Quantity	Rate	Total
Transfer from P ₁	4,750 tonnes	Rs. 32.61	Rs. 1,54,900
Direct labour			45,000
Overheads			38,000
Total			2,37,900
Less : Wastage 10% @ Rs. 12	475		5,700
Net Sale to customer X and Y	4,275	54,316	2,32,200.00
			2,51,322.50
Net profit			19,122.50

Market penetration and total contribution for sales areas

Problem 10'45. Cool Ltd. sells a gadget and has estimated the market capacity as 50,000 units a year. The Directors have set the company a sales objective of between 50% and 80% of this potential. The sales force is divided into five equal areas and the objective is expected to be achieved by using the salesmen in the following manner :

<i>Number of salesmen used per area</i>	<i>Market penetration expected</i>
5	50%
6	58
7	65
8	71
9	76
10	78
11	80

All the products are manufactured at one location at an ex-factory cost of Rs. 80 each and are sold at a standardised price of Rs. 100 each. The transport and installation cost varies in relation to the distance from the factory as under :

<i>Sales area</i>	<i>Variable distribution cost per unit</i>
1	Rs. 10
2	8
3	6
4	4
5	2

At present 35 salesmen are employed at an average cost of Rs. 8,000 each per annum. In 1984 they were divided evenly among the five areas. In 1985 the Sales Manager decided to use 25 salesmen to meet the basic 50% penetration in all areas and to concentrate the other ten salesmen equally in the two areas nearest the factory where the unit contribution is highest. The calculations the a shown below indicate that this year the profit will be nearly 60% lower than that in 1984.

	<i>1984</i>		<i>1985</i>
	<i>Rs. ('000)</i>		<i>Rs. ('000)</i>
Incomes from sales		3,250	3,060
Ex-factory cost	2,600		2,448
Distribution cost	195		167
Salesmen cost	280	3,075	280
			2,895
Total contribution		175	165

You are required to :

- analyse the total contribution by areas for both 1984 and 1985 ;
- explain briefly why concentrating on highest contribution areas has not increased profit ; and
- calculate the highest total contribution possible using 35 salesmen.

(I.C.W.A. Final, June 1986)

Solution :

COOL LTD.

(a) Statement showing the total contribution by areas both for 1984 and 1985

(Rs. in thousands)

Areas	1984					1985				
	1	2	3	4	5	1	2	3	4	5
Sales (Refer to Note 1)	650	550	650	550	650	500	500	500	780	780
Costs : Ex-factory cost @ Rs. 80 per unit (Refer to Note No. 2)	220	520	520	520	520	400	400	400	624	624
Distribution cost (Refer to Note No. 3)	65	52	39	26	13	50	40	30	31	16
Salesmen cost (Refer to Note No. 4)	56	56	56	56	56	40	40	40	80	80
Total cost	641	628	615	602	589	490	480	470	735	720
Contribution	9	22	35	48	61	10	20	30	45	60

(b) It is clear from the above table that profit has gone down in 1985 even when company concentrated on highest contribution areas, i.e., No. 4 and No. 5 (From the table in working Note No. 1 (b), it is clear that unit contribution in areas 4 and 5 is highest). For maximum profit, company should employ its sales force in areas where marginal contribution per salesman (i.e., incremental contribution due to additional salesman) is highest.

(c) In Note No. 5 table (b), marginal contribution per salesman is given. Five salesman have to be necessarily employed in each area for 50% capacity and the balance force of 10 salesmen (i.e., 35 salesmen-25 salesmen) should be used as follows.

No. of salesman	Area No	For incremental contribution of Rs. [Refer to table (b) in Note No. 5]
26th Salesman	5	Rs. 14,400
27th ..	4	Rs. 12,800
28th ..	5	Rs. 12,000
29th ..	3	Rs. 11,200
30th ..	4	Rs. 11,200
31st ..	5	Rs. 10,800
32nd ..	3	Rs. 9,800
33rd ..	2	Rs. 9,600
34th ..	4	Rs. 9,400
35th ..	5	Rs. 9,600

- | | |
|-----------------------------------------------------------------------------|---|
| 4 Additional salesmen should be used in area No. 5 making total sales force | 9 |
| 3 Additional salesmen should be used in Area No. 1 making total sales force | 8 |
| 2 Additional salesmen should be used in Area No. 3 making total sales force | 7 |
| 1 Additional salesmen should be used in area No. 2 making total sales force | 6 |

If sales force is used as advised above, the company will make the highest profit. This is worked out below :

Area	No. of salesmen	Contribution for the proposed sales force as per table (a) of working Note No. 5
1	5	Rs. 50,000
2	6	69,600
3	7	91,000

4	8	1,13,600
5	9	1,36,800
Total		4,61,000
Less : Salaries of 35 salesmen (35 × Rs. 8,000)		2,80,000
Profit		1,81,000

Working Notes :

(1) (a) **Sales for 1984.** Total sale given is Rs. 32,50,000. In 1984, the sales force was equally divided. Therefore, sales in each area in 1984 will be Rs. 6,50,000 i.e., $\text{Rs. } 32,50,000 \div 5$.

(b) **Sales for 1985.** In 1985, the sale manager decided to use 25 salesmen to meet the basic 50% penetration in all areas and to concentrate the other ten salesmen equally in the two areas nearest to factory, where unit contribution is highest. Therefore, first step should be to find out which areas are giving the highest unit contribution. The excess of sales over 50% of capacity should be distributed in two territories with highest unit contribution. Table showing unit contribution in different areas :

Areas	1	2	3	4	5
	Rs.	Rs.	Rs.	Rs.	Rs.
Selling price per unit	100	100	100	100	100
Less : Ex-Factory cost	80	80	80	80	80
Gross contribution	20	20	20	20	20
Distribution cost (per unit)	10	8	6	4	2
Net contribution	10	12	14	16	18

∴ Excess sales over 50% of capacity is to be distributed in Area 4 and area 5.

Table showing sales in 1985

Areas	1	2	3	4	5
Normal capacity in units (50,000 units ÷ 5)	10,000	10,000	10,000	10,000	10,000
50% of normal capacity (in units)	5,000	5,000	5,000	5,000	5,000

Minimum sales in all areas (5,000 × Rs. 100)	5,00,000	5,00,000	5,00,000	5,00,000	5,00,000
*Excess of actual sales of 1985 over minimum sales to be distributed in Areas 4 and 5				2,80,000	2,80,000
	5,00,000	5,00,000	5,00,000	7,80,000	7,80,000

$$*[\text{Rs. } 30,60,000 - 5 (\text{Rs. } 5,00,000)] \div 2.$$

Note No. 2. Ex-factory cost in 1984

Area	Sales (Rs.)	Sales in units	Ex-factory cost per unit	Ex-factory cost in different areas
1	6,50,000	6,500	Rs. 80	Rs. 5,20,000
2	6,50,000	6,500	80	5,20,000
3	6,50,000	6,500	80	5,20,000
4	6,50,000	6,500	80	5,20,000
5	6,50,000	6,500	80	5,20,000

In 1985

Area	Sales (Rs.)	Sales in units	Ex-factory cost per unit	Ex-factory cost in different areas
1	Rs. 5,00,000	5,000	Rs. 80	Rs. 4,00,000
2	5,00,000	5,000	80	4,00,000
3	5,00,000	5,000	80	4,00,000
4	7,80,000	7,800	80	6,24,000
5	7,80,000	7,800	80	6,24,000

Note No. 3. (a) Distribution cost in 1984

Area	Sales (Rs.)	Sales in units	Distribution cost per unit	Distribution cost for different areas
1	6,50,000	6,500	Rs. 10	Rs. 65,000
2	6,50,000	6,500	8	52,000
3	6,50,000	6,500	6	39,000
4	6,50,000	6,500	4	26,000
5	6,50,000	6,500	2	13,000

(b) Distribution cost in 1985

Area	Sales (Rs.)	Sales in units	Distribution cost per unit	Distribution cost for different areas
1	5,00,000	5,000	Rs. 10	50,000
2	5,00,000	5,000	8	40,000

3	5,00,000	5,000	6	30,000
4	7,80,000	7,800	4	31,200
5	7,80,000	7,800	2	15,600

Note No. 4. Salesmen cost

1984				1985		
Areas	No. of salesmen	Average cost per salesman	Total Remuneration	No. of salesmen	Average cost per salesman	Total remuneration
1	7	Rs. 8,000	Rs. 56,000	5	Rs. 8,000	40,000
2	7	8,000	56,000	5	8,000	40,000
3	7	8,000	56,000	5	8,000	40,000
4	7	8,000	56,000	10	8,000	80,000
5	7	8,000	56,000	10	8,000	80,000
	35		2,80,000	35		2,80,000

Note No. 5

(a) Table showing the contribution in different areas with employment of different labour force

Number of salesmen used per area	Market Penetration	Contribution per unit Normal capacity is 10,000, i.e., 50,000 ÷ 5	Areas				
			1	2	3	4	5
			Rs. 10	12	14	16	18
5	50%	5,000	50,000	60,000	70,000	80,000	90,000
6	58%	5,800	58,000	69,600	81,200	92,800	1,04,400
7	65%	6,500	65,000	78,000	91,000	1,04,000	1,17,000
8	71%	7,100	71,000	85,200	99,400	1,13,600	1,27,800
9	76%	7,600	76,000	91,200	1,06,400	1,21,600	1,36,800
10	78%	7,800	78,000	93,600	1,09,200	1,24,800	1,40,400
11	80%	8,000	80,000	96,000	1,12,000	1,28,000	1,44,000

Table (b) Statement showing the incremental contribution (i.e., if 6th salesman is employed or 7th salesmen is employed and so on.....) per salesman

Contribution increase due to	Areas				
	1	2	3	4	5
6th Salesman	(Rs.) 8,000	(Rs.) 9,600 (33rd)	(Rs.) 11,200 (29th)	(Rs.) 12,800 (27th)	(Rs.) 14,400 (26th)
7th „	7,000	8,400	9,800 (32nd)	11,200 (30th)	12,600 (28th)
8th „	6,000	7,200	8,400	9,600 (34th)	10,800 (31st)
9th „	5,000	6,000	7,000	8,000	9,000 (35th)
10th „	2,000	2,400	2,800	3,200	3,600
11th „	2,000	2,400	2,800	3,200	3,600
Salesman employed in excess of 5.	—	1	2	3	4

Calculation for table (b) has been done as follows :

No. of salesmen	Areawise contribution as per table (a)				
	1	2	3	4	5
5	50,000	60,000	70,000	80,000	90,000
6	58,000	69,600	81,200	92,800	1,04,400
Incremental contribution due to 6th salesman	8,000	9,600	11,200	12,800	14,400

Similarly incremental contribution for other salesmen has been found out.

COST INDIFFERENCE POINT

Problem 10.46. Standard Pump Ltd., is manufacturing petrol and diesel operated pumps. The company wants to have a customer survey before marketing the pumps. You are asked to work out the economics of choice between the two types of pumps. The company provides you the following data :

	<i>Petrol-operated pump 'X'</i>	<i>Diesel-operated pump 'Y'</i>
Selling price	Rs. 8,000	17,750
Cost of fuel per litre	Rs. 8.00	3.00
Operating hours per litre	20.00	40.00

Using above data answer following questions :

(i) How many hours the pumps should run so that the customer willing to buy is indifferent in choice between X and Y ? Assume that fuel cost has linear function with respect to time.

(ii) Assuming the price of X remains unchanged, and the customer wants to run the pump for 10,000 hours, how much he will be willing to pay for Y ?

(iii) If Standard Pump Ltd., offers to convert a petrol-operated pump to diesel-operated one after 10,000 hours of operation of the former, how much customer will be willing to pay for this modification of the pump ?

(iv) If there is a saving of Rs. 3,250 in operating cost of Y over its life, how many hours the customer should expect to run the pumps so as to be indifferent in choice ?

(v) If there is a restriction on the fuel supply to the extent of 700 litres for both petrol and diesel, what will be customer's preference either for petrol operated or diesel operated one ?

(vi) Do you suggest any other point should be considered for choice between alternatives apart from above ?

Ignore interest on capital.

(I.C.W.A. Final, Dec. 1986)

Solution. Cost indifference point is the point or level of activity at which costs under two alternatives are equal :

(i) Suppose operating hours = x . That point of operating hours at which cost under two alternatives is equal, will be the cost indifference point.

Total cost for x hours, if petrol-operated pump is used :

$$\text{Rs. } 8,000 - 8x/20 \quad \dots(i)$$

Total cost for x hours, if diesel-operated pump is used :

$$\text{Rs. } 17,750 + 3x/40 \quad \dots(ii)$$

Equating (i) and (ii) for cost indifference point

$$\text{Rs. } 8,000 + 8x/20 = 3x/40 + 17,750$$

$$\text{Rs. } 8,000 + 0.4x = 0.075x + \text{Rs. } 17,750$$

$$0.325x = \text{Rs. } 9,750 \quad \text{or } x = 30,000 \text{ hours.}$$

(ii) Suppose price to be offered for $Y=x$. Now total cost for petrol-operated pump for 10,000 hours and total cost of diesel-operated pump for 10,000 hours with x price of Y should be equated.

$$\therefore \text{Rs. } 8,000 + 8/20 \times 10,000 = x + 3/40 \times 10,000$$

$$\text{Or Rs. } 12,000 = x + \text{Rs. } 750 \quad \text{or } x = \text{Rs. } 11,250$$

\therefore Rs. 11,250 is the price at which cost indifference point will occur.

\therefore Customer will be willing to pay for Y Rs. 11,250.

(iii) Customer will be willing to pay for modification, if the revenue savings compensate for the replacement cost. Cost indifference point occurs at 30,000 hours and pump has run for 10,000 hours.

$$\therefore \text{Revenue saving} = 20,000 \times (\text{savings in operating cost})$$

$$= 20,000 \times \left(\frac{8}{20} - \frac{3}{40} \right)$$

$$= 20,000 \times \frac{13}{40} = \text{Rs. } 6,500.$$

\therefore The customer may permit to pay the replacement cost up to Rs. 6,500.

(iv) Suppose required hours = z

Total cost from pump X for Z hours — total cost from pump Y for Z hours — Savings of Rs. 3,250.

$$\therefore \left(\text{Rs. } 8,000 + \frac{8z}{20} \right) - \left(\text{Rs. } 17,750 + \frac{3z}{40} \right) = \text{Rs. } 3,250$$

$$\therefore \text{Rs. } 8,000 + 0.4z - 17,750 - 0.075z = \text{Rs. } 3,250$$

$$0.325z = \text{Rs. } 13,000 \quad \text{or } z = 4,000 \text{ hours.}$$

(v) Total cost of 'Pump X ' for 700 litres

$$= \text{Rs. } 8,000 + 700 \text{ litres} \times \text{Rs. } 8 \quad \text{or Rs. } 13,600$$

$$\therefore \text{Cost per hour} = \frac{\text{Rs. } 13,600}{20 \times 70} \quad \text{or Re. } 0.97.$$

Total cost of Pump 'Y' for 700 litres

$$= \text{Rs. } 17,750 + 700 \text{ litre} \times \text{Rs. } 3$$

$$= \text{Rs. } 19,850$$

$$\text{Cost per hour} = \frac{\text{Rs. } 19,850}{40 \text{ hours} \times 700} \quad \text{or Re. } 0.71.$$

\therefore Customer should opt for alternative 'Y', i.e., diesel-operated pump.

Constructing own toy mould vs. Subcontracting

Problem 10.47. Modern Packaging Corporation specialises in the manufacture of one-litre plastic bottles. The firm's customers include dairy processors, fruit juice manufacturers and manufacturers of edible oils. The bottles are produced by a process called blow moulding. A machine heats plastic to the melting point. A bubble of molten plastic is formed inside a mould, and a jet of hot air is forced into the bubble. This blows the plastic into the shape of the mould. The machine releases the moulded bottle, an employee trims off any flashing (excess plastic around the edge), and the bottle is complete.

The firm has four moulding machines, each capable of producing 100 bottles per hour. The firm estimates that the variable cost of producing a plastic bottle is 20 paise. The bottles are sold for 50 paise each.

Management has been approached by a local toy company that would like the firm to produce a moulded plastic toy for them. The toy company is willing to pay Rs. 3.00 per unit for the toy. The variable cost to manufacture the toy will be Rs. 2.40. In addition, Modern Packaging Corporation would have to incur a cost of Rs. 20,000 to construct the needed mould exclusively for this order. Because the toy uses more plastic and is of a more intricate shape than a bottle, a moulding machine can produce only 40 units per hour. The customer wants 1,00,000 units. Assume that Modern Packaging Corporation has the total capacity of 10,000 machine hours available during the period in which the toy company wants the delivery of toys. The firm's fixed costs, excluding the costs to construct the toy mould, during the same period will be Rs. 2,00,000. Required :

(a) If the management predicts that the demand for its bottles will require the use of 7,500 machine hours or less during the period, should the special order be accepted? Give reasons.

(b) If the management predicts that the demand for its bottles will be higher than its ability to produce bottles, should the order be accepted? Why?

(c) The management has located a firm that has just entered the moulded plastic business. This firm has considerable excess capacity and more efficient moulding machines and is willing to subcontract the toy job, or any portion of it for Rs. 2.80 per unit. It will construct its own toy mould. Determine Modern Packaging Corporation's minimum expected excess machine hour capacity needed to justify producing any portion of the order itself rather than subcontracting it entirely.

(d) The management predicted that it would have 1,600 hours of excess machine hour capacity available during the period. Consequently, it accepted the toy order and subcontracted 36,000 units to the other plastic company. In fact demand for bottles turned out to be 9,00,000 units for the period. The firm was able to produce only 8,40,000 units because it had to produce the toys. What was the cost of the prediction error failure to predict demand correctly?

(C.A. Final, Nov. 1985; I.C.W.A. Final June 1989)

Solution : (a) Whether special order should be accepted

Total capacity of Modern Packaging Corporation is 10,000 machine hours. Out of this 7,500 machine hours will be utilized for production of plastic bottles and the balance 2,500 machine hours will be utilized for producing the toys for a local toy company. The profitability of producing toys is as under :

Sales realisation per unit of toy		=Rs. 3 00
Less : Variable cost per unit		= 2 40
Contribution per unit		0 60
Hourly production of toy	=40 units	
Contribution per hour	0 60 × 40	or Rs. 24
Contribution from 2,500 hours	= 24 × 2,500	or Rs. 60,000
Less : Additional fixed cost of mould		20,000
Net profit		40,000

In this case, the company is not able to utilize 10,000 machine hours. The spare capacity of 2,500 machine hours will have to be shifted for production of 1,00,000 units of toys (2,500 machine hours × 40 units per hour). This special order should be accepted as it yields net profit of Rs. 40,000.

(b) Whether the order should be accepted if the demand for the bottles is higher than the production capacity

	Bottles	Toys
(i) Contribution per unit (Rs.)	0 30	0 60
(ii) Hourly production (Nos)	100	40
(iii) Contribution per hour (i) × (ii)	30 00	24 00

In the present case machine hour is the limiting factor. The contribution in terms of this limiting factor is higher in case of bottles than the contribution from toys. Therefore, if the management predicts that the demand for its bottles will be higher than its ability to produce bottles, the special order should not be accepted. The entire machine hours available should be utilized for production of bottles. The imbalance, if any, in the existing plant should be corrected by adding balancing equipment. This step will help in increasing the profitability of the company.

(c) It is required to determine company's minimum expected excess machine hour capacity needed to justify producing any portion of the order itself rather than subcontracting it entirely. In other words, we have to find out the point at which the company will be indifferent whether to produce the toys itself or subcontract them to a firm. When the company has excess capacity and it decides to produce the toys itself, the total cost will be :

Fixed cost + (Variable cost per unit \times Number of units produced) (i)
 Rs. 20,000 + Rs. 2.40 \times x [x = Number of units produced].

When the company decides to subcontract to a firm, the total cost will be : Rs. 2.80 x (ii)

The company will be indifferent between two alternatives when the total costs of these alternatives are equal at a particular level of production : (i) = (ii).

$$\text{Rs. } 20,000 + \text{Rs. } 2.40x = \text{Rs. } 2.80x \quad \text{or } x = 50,000 \text{ units}$$

In one hour 40 units are produced. So the machine hours required for 50,000 units

$$50,000 \div 40 = 1,250 \text{ hours.}$$

Verification. Net profit under two alternatives :

	When produced	When Subcontracted
Production	50,000 units	50,000 units
Contribution per unit	Rs. 0.60	Rs. 0.20
Total contribution	30,000	10,000
Less : Fixed cost	20,000	—
Net profit	10,000	10,000

If the company has an excess capacity of more than 1,250 machine hours, it will be advisable to manufacture the toys itself. Otherwise the company should subcontract the job to a firm.

(d) Cost of predictive error

Subcontracted = 36,000 units
 Total demand of the toys = 1,00,000 units
 Toys to be self manufactured = 1,00,000 - 36,000 = 64,000 units
 The economics of this proposal is :

Details	Bottles produced	Toys		Total
		Self-manufactured	Sub-contracted	
Units produced/contracted	8,40,000	64,000	36,000	
Contribution per unit	Rs. 0.30	Rs. 0.60	Rs. 0.20	
Total contribution	2,52,000	38,400	7,200	2,97,600
Less : Fixed costs	2,00,000	20,000	—	2,20,000
Net profit	52,000	18,400	7,200	77,600

The company has the total available capacity of 10,000 machine hours and hourly production rate is 100 bottles. Therefore, 1,00,000 bottles can be produced with the existing available capacity. During the period under study the company produced 8,40,000 bottles but the actual demand turned out to be 9,00,000 bottles, requiring 9,000 machine hours. In this case, only 1,000 excess machine hours are available for production of toys. In part (c) of this problem, the final conclusion was in favour of production of toys only if more than 1,250 excess machine hours are available. Therefore, the company should produce 9,00,000 bottles itself and the entire production of toys (1,00,000 units) should be sub-contracted. The economics of this alternative will be as under :

	<i>Bottles (self manufactured)</i>	<i>Toys (sub- contracted)</i>	<i>Total</i>
Units produced/subcontracted	9,00,000	1,00,000	
Contribution per unit	Rs. 0.30	Rs. 0.20	
Total contribution	2,70,000	20,000	2,90,000
Less : Fixed costs	2,00,000	-	2,00,000
Net profit	70,000	20,000	90,000

Thus the cost of predictive error will be :

Total Net profit when 9,00,000 bottles are produced	Rs. 90,000
Total Net profit when 8,40,000 bottles are produced	Rs. 77,600
Cost of predictive error	12,400

CHOICE OF BEST ALTERNATIVE

Continue or closing down a Department

Problem 10-48. Reel and Roll Ltd. manufactures a range of films extensively used in the cinema industry. The films once manufactured are packed in a circular container and stored in specially constructed crates lined with "protecto". These crates are manufactured and maintained by a special department within the company and the departmental costs last year are as under :

Direct materials (including 'protecto')	Rs. 1,40,000
Direct labour	1,00,000
	<u>2,40,000</u>

Overheads :

Department manager	16,000
Depreciation of machine	30,000
Maintenance of machine	7,200

Rent (portion of warehouse)	9,000	
Other miscellaneous costs	31,500	93,700
		<hr/>
		3,33,700
Administration overhead (20% of direct costs)		48,000
		<hr/>
		3,81,700
		<hr/>

Pack Knack Associates have approached the Reel and Roll Ltd., offering to make all the crates required on a four-year contract for Rs. 2,50,000 per annum and/or to maintain them for a further Rs. 50,000 per annum.

The following data are relevant :

(i) The machine used in the department costs Rs. 2,40,000 four years ago and will last for four more years. It could be currently sold for Rs. 50,000.

(ii) A stock of "protecto" was acquired last year for Rs. 2,00,000 and one-fifth was used last year and included in the material cost. It originally cost Rs. 1,000 per tonne, but the replacement cost is Rs. 1,200 per tonne ; and it could be currently sold for Rs. 800 per tonne.

(iii) The department has acquired warehouse space for Rs. 18,000 per annum. It uses only one-half of the space ; the rest is idle.

(iv) If the department were closed, the Manager will be transferred to another department and the terminal benefits to be met will amount to Rs. 15,000 per annum. In that event, Pack Knack Associates will undertake to manufacture and maintain the crates.

If the Reel and Roll Ltd., continued to maintain the crates, but left their manufacture to Pack Knack Associates :

- (i) The machine will not be required.
- (ii) The manager will remain in the department.
- (iii) The warehouse space requirements will not be reduced.
- (iv) Only 10% of all materials will be used.
- (v) Only one worker will be dispensed with and taking the terminal benefit to be met into account, the saving will be Rs. 5,000 per annum.
- (vi) The miscellaneous costs will be reduced by 80%.

If Reel and Roll Ltd., continue to manufacture the crates but left their maintenance to Pack Knack Associates :

- (i) The machine will be required.
- (ii) The manager will remain in the department.
- (iii) The warehouse space will be required
- (iv) 90% of all the materials will be required.

(v) The labour force will continue.

(vi) The miscellaneous costs will be reduced by 20%.

Assuming that for the four-year period, there is no significant change envisaged in the pattern of other costs, you are required to evaluate the alternative courses of action with supporting figures of cash flows over the four year period and advise accordingly.

(C.A. Final, May 1984)

Suggested approach

In the present problem it is required to evaluate the three alternatives giving the cash flow position over the four-year period. Only those items of costs and revenue should be included in the comparative statement which have direct bearing on cash flows. Following computations should be thoroughly understood before attempting the problem :

(i) Direct materials under three alternatives have to be found out. Last year's direct materials cost includes the cost of "protecto". Direct material cost without "protecto" is as under :

Direct material (including "protecto")	Rs. 1,40,000
Less : One-fifth cost $\left(\text{Rs. } 2,00,000 \times \frac{1}{5} \right)$	40,000
Direct material cost	1,00,000

Under the second alternative, it is given that only 10% of all the materials will be used. It means that 10% of Rs. 1,00,000, i.e., Rs. 10,000 worth of materials have been used. Thus, there is a cash saving of Rs. 90,000 in this proposal. This point should be noted carefully.

(ii) If the department manufacturing and maintaining cranes is closed, the company has to pay terminal benefits to direct workers amounting Rs. 15,000 per month. In other words, there will be a net cash saving of Rs. 85,000 (direct labour cost, i.e., Rs. 1,00,000 minus terminal benefits—Rs. 15,000).

(iii) Overheads which do not effect cash flows are not considered in these alternatives. For example, if the departmental manager is transferred to another department, the overhead pertaining to this department will not figure in the cash flow statement. Similarly, depreciation on machinery does not entail cash outlay and as such this item of cost will not find a place in cash flow statement.

(iv) Rent—Rs. 9,000 is considered in the last year's departmental cost. This represents only 50% of rent. Therefore for cash flow purpose full rent (Rs. 18,000) has to be considered.

(v) Similarly, the wording "miscellaneous cost will be reduced by 80%," should be properly understood. It means miscellaneous costs to the extent of 80% of last year's cost will be considered for the purpose of cash flow.

Solution :**Reel and Roll Ltd.****Statement showing cash flow of three alternative courses of action**

<i>Details</i>	<i>Alternative I Deptt. will be closed and Pack Knack Associates will undertake to manufacture and maintain the crates</i>	<i>Alternative II The Deptt. of the company will continue to maintain the crates but these will be manufactured by Pack Knack Associates</i>	<i>Alternative III. The Deptt. of the com- pany will continue to manufac- ture the crates but these will be main- tained by Pack Knack Associates</i>
	Rs.	Rs.	Rs.
Cash inflows :			
(Avoidable costs in terms of cash flows) :			
Direct material (except "protecto")	1,00,000 ¹	90,000	10,000
Direct labour	85,000 ²	5,000	—
Maintenance of machine	7,200	7,200	— ³
Rent (full)	18,000 ⁴	—	—
Other miscellaneous costs	31,500	25,200	6,300
Total avoidable costs per annum	2,41,700	1,27,400	16,300
Total avoidable costs in 4 years (A)	9,66,800	5,09,600	65,200
Cash outflows :			
Cash flow per annum (Payment to Pack Knack)	3,00,000	2,50,000	50,000
Cash outflow in 4 years	12,00,000	10,00,000	2,00,000
Less : Sales proceeds	Rs. 50,000	Rs. 50,000	
sales of 'protecto' stock	1,28,000 ⁵	1,15,200	12,800
Total cash outflow in 4 years (B)	10,22,000	8,34,800	1,87,200
Advantages (Disadvantages) in 4 years (B) - (A)	(55,200)	(325,200)	(1,22,000)

It is seen from the above computations, that none of the proposals is advantageous to Reel and Roll Ltd. The company should not close down the department and manufacture and maintenance of the crates will be continued by the company.

Notes : 1. For working, please see suggested approach (i).

2. Please refer to suggested approach (ii).

3. Crates will be maintained by Pack Knack Associates and as such no cost will be incurred in maintenance of machine by the company under this alternative.

4. Please refer to suggested approach (iii). Under alternatives II and III, the warehouse space will be required. Therefore, there is no saving in this item of cost.

5. Stock of 'protecto' acquired last year	=Rs. 2,00,000
Less : Transferred to material cost	40,000
	<hr/>
Value of protecto stock	1,60,000
Original rate per tonne	1,000
Stock of 'protecto' in terms of quantity	= $1,60,000 \div 1,000 = 160$
	tonnes
Present sales value per tonne	= Rs. 800

Therefore, the value of stock of 'protecto' sold is arrived at as under :

$$\text{Alternative I} = 160 \times 800 = \text{Rs. } 1,28,000$$

$$\text{Alternative II} = 160 \times \frac{9}{10} \times 800 = 1,15,200$$

$$\text{Alternative III} = 160 \times \frac{1}{10} \times 800 = 12,800.$$

The sale proceeds of stock of 'protecto' and machinery can be alternatively added to total avoidable costs of 4 years' instead of deducting them from the cash flow. These sales proceeds will accrue only for a period of one year. This point should be carefully noted by the readers.

Mutually exclusive sales strategies

Problem 10.49. Pure Pleasure and Lingering Taste Ltd., manufactures and markets two kinds of chocolate bars under the trade names 'Milkie' and 'Nuttie'.

The following figures are from last year's operations

	<i>Milkie</i>	<i>Nuttie</i>
Units sold	80,000	2,40,000
Production cost per bar	Rs. 4	Rs. 3
Selling price per bar	Rs. 6	Rs. 4

Selling expenses (one-third of which is advertising)	18% of sales	15% of sales
Administration expenses	8% of sales	8% of sales

For the current year, the marketing manager has submitted for consideration of the management two mutually exclusive sales strategies. Both are intended to increase the unit sales volume and at the same time effect decrease in unit production cost. The changes proposed are as under :

Strategy 1 :

	<i>Milkie</i>	<i>Nuttie</i>
Increase in unit sales volume	50%	33½%
Decrease in unit production cost	8%	10%
Administration expenses	5% of sales	5% of sales
Selling expenses other than advertising	Same rate as last year	Same rate as last year

Strategy 2 :

Increase in unit sales volume	45%	40%
Decrease in unit production cost	7%	10%
Administration expenses	Same amount as last year for both Milkie and Nuttie	
Selling expenses other than advertising	Same rate as last year for both Milkie and Nuttie.	

Besides, strategy 1 is based on the introduction of the following "learn as you eat" scheme. The company will print and issue pictorial stamps in attractive colours in three series. One covering the wild life of the world, second places of historical interest in the world and the third on Heavenly Bodies and Mysterious Universe. Each package of Milkie bar would contain three stamps and each package of Nuttie bar would contain two stamps. Albums where the stamps have to be pasted would be supplied free to consumers. When 50 stamps are pasted in the album and submitted to the company, the company will give a cash prize of Rs. 5 for each such album. The cost of the scheme would be the printing of the pictorial stamps at Rs. 5 per 1,000 stamps and the printing and distribution of the album at Rs. 60 per 1,000 numbers, besides cash prize. This scheme would be in lieu of all previous advertising and the existing selling prices would be maintained.

Strategy 2 envisages a reduction in selling price and an increase in advertisement expenses. The selling price of Milkie would be reduced by 8½% and that of Nuttie by 7½%. Advertisement expenditure would be increased by 33½% of the rate of advertising cost incurred last year.

You are required to prepare a detailed report for management productwise ; comparing the operations of last year with both the strategies proposed for the current year and give your recommendations.

(I.C.W.A. Final, June 1984)

Solution :

<i>Basic Data</i>	<i>Last year</i>		<i>Current year Strategy 1</i>		<i>Current year Strategy 2</i>	
	<i>Milkie</i>	<i>Nuttie</i>	<i>Milkie</i>	<i>Nuttie</i>	<i>Milkie</i>	<i>Nuttie</i>
Units sold	80,000	2,40,000	1,20,000	3,20,000	1,16,000	3,36,000
Unit Selling price (Rs.)	6'00	4'00	6'00	4'00	5'50	3'70
Unit production cost (Rs.)	4'00	3'00	3'68	2'70	3'72	2'70
Advertisement cost as percentage of sales	6	5	—	—	8	6½
Other selling costs as % of sales	12	10	12	10	12	10
Administration expenses as % of sales	8	8	5	5	Same amount as last year.	

(See table on page P10-115)

Sell as scrap, rework or as substitute material

Problem 10-50. Novel Accessories have been manufacturing alloy figurettes to be fitted on car bonnets. One of the figurettes resembles a tiny model of Asokan Pillar with the Lion Capital. As the cars fitted with these have been mistaken by public as belonging to Government dignitaries, on a complaint, the police authorities have banned the use of this on car bonnets. The company is now left with inventories of 8,000 units of this figurette and manufacturing cost per unit were as follows :

Materials	Rs. 1'20
Labour	0'80
Fixed overhead	0'50
	<hr/>
	2'50
	<hr/>

Prior to being banned, the selling price was Rs. 3 per unit. The costs for this figurette costs Rs. 1.000, when originally acquired. The company has examined the situation and has come out with three alternative courses of action :

(i) Sell the units as scrap for Rs. 6,500.

(ii) Rework them by putting a base on them which would allow them to be sold as drawing room curios at a price of Rs. 3'20 each. Such work would require Rs. 2 per unit of additional labour and a fixed overhead charge of Rs. 1 each would be entailed in terms of the company's absorption costing system. No further materials would be required.

(Contd on page P-10-116)

	Last year			Current year—strategy 1			Current year—strategy 2		
	Milkie	Nuttie	Total	Milkie	Nuttie	Total	Milkie	Nuttie	Total
Sales Revenue	4,80,000	9,60,000	14,40,000	7,20,000	12,80,000	20,00,000	6,38,000	12,43,200	18,81,200
Selling Expenses :									
Stamp plan	—	—	—	42,120	74,880	1,17,000	—	—	—
Advertisement	28,800	48,000	76,800	—	—	—	51,010	82,880	1,33,920
Other selling exp.	57,600	96,000	1,53,600	86,400	1,28,000	2,14,400	76,560	1,24,320	2,00,880
Admn. Expenses	38,400	76,800	1,15,200	36,000	64,000	1,00,000	38,400	76,800	1,15,200
Production cost of goods sold	3,20,000	7,20,000	10,40,000	4,41,600	8,64,000	13,05,600	4,31,520	9,07,200	13,38,720
Total expenses	4,44,800	9,40,800	13,85,600	6,06,120	11,30,880	17,37,000	5,97,520	11,91,200	17,88,720
Income	35,200	19,200	54,400	1,13,880	1,49,120	2,63,000	40,480	52,000	92,480

Note : Cost per album

Prize	Rs. 5'00
50 stamps	0'25
Cost	0'60
	5'85

∴ Cost of stamp plan per stamp = $5'85 \div 50 = \text{Rs. } 0'117$.
 Milkie 3 stamps = $0'117 \times 3 \times 1,20,000 = \text{Rs. } 42,120$.
 Nuttie 2 stamps = $0'117 \times 2 \times 3,20,000 = \text{Rs. } 74,880$.
 Recommendation. Strategy 1 to be adopted.

(from page P10-114)

(iii) Melt them down and use the material as a substitute in a strong selling 'iae where the metal currently used costs 50% more than the metal used in the figuette. This process would incur a material loss of three-eighths of the original metal.

You are required to examine each of these alternatives and arrive at the decision which would result in the greatest benefit to the company. Your calculations should be justified by appropriate reasoning and explanation.

[C.A. (Final), Nov. 1983]

Solution. This is a situation where only relevant cost and relevant benefit should be matched for specific decision making. In this situation Rs. 2.50 per unit is a sunk cost. The analysis for the given purpose should proceed as follows :

Alternative 1

This alternative gives a revenue of Rs. 6,500 without incurring any further cost.

Alternative 2

The additional charge Re. 1 per unit due to absorption costing is an irrelevant consideration for the given purpose. Only incremental cost and incremental revenue should be matched in this situation and, therefore, income under this alternative will be :

$$\begin{aligned} & (8,000 \times \text{Rs. } 3.20) - (8,000 \times \text{Rs. } 2.00) \\ &= \text{Rs. } 25,600 - \text{Rs. } 16,000 \quad \text{or} \quad \text{Rs. } 9,600. \end{aligned}$$

Alternative 3

Metal cost recovered will be :

$$\begin{aligned} & (8,000 \times 1.20) - 3/8 (8,000 \times 1.20) \\ &= \text{Rs. } 9,600 - 3,600 \quad \text{or} \quad \text{Rs. } 6,000. \end{aligned}$$

By using this material, company will be able to save material of the value of :

$$6,000 + 50\% \text{ of it} \quad \text{or} \quad \text{Rs. } 9,000.$$

(Since cost of melting is not given, it is ignored).

An examination of above alternatives reveals that greatest benefit, i.e., benefit of Rs. 9,600 will accrue to company by adopting 2nd alternative. Hence, 2nd alternative is recommended.

Duration of picture shows in a cinema theatre—Incremental approach

Problem 10-51. The Officers' Recreation Club of a large public sector undertaking has a cinema theatre for the exclusive use of themselves and their families. It is a bit difficult to get good motion pictures for show and so pictures are booked as and when available.

The theatre has been showing the picture "Blood Bath" for th.

past two weeks. This picture, which is strictly for adults only has been a great hit and the Manager of the theatre is convinced that the attendance will continue to be above normal for another two weeks, if the show of "Blood Bath" is extended. However, another popular movie, eagerly looked forward to by both adults and children alike, "Appu on the Airbus" is booked for next two weeks. Even if "Blood Bath" is extended, the theatre has to pay the regular rental on "Appu on the Airbus" as well.

Normal attendance at the theatre is 2,000 patrons per week, approximately one-fourth of whom are children under the age of 12. Attendance for "Blood Bath" has been 50% greater than the normal total. The manager believes that this would taper off during the second two weeks, 25% below that of the first two weeks, during the third week and 33½% below that of the first two weeks, during the fourth week. Attendance for "Appu on the Airbus" would be expected to be normal throughout its run, regardless of the duration.

All runs at the theatre are shown at a regular price of Rs. 2 for adults and Rs. 1.20 for children under 12. The rental charge for "Blood Bath" is Rs. 900 for one week or Rs. 1,500 for two weeks. For "Appu on the Airbus" it is Rs. 750 for one week or Rs. 1,200 for two weeks. All other operating costs are fixed—Rs. 4,200 per week, except for the cost of potato wafers and cakes, which average 60% of their selling price, sales of potato wafers and cakes regularly average Rs. 1.20 per patron, regardless of age.

The Manager can arrange to show "Blood Bath" for one week and "Appu on the Airbus" for the following week; or he can extend the show of "Blood Bath" for two weeks; or else he can show "Appu on the Airbus" for two weeks as originally booked.

Show by computation, the most profitable course of action he has to pursue (C.A. Final, May 1974)

Solution : Statement showing the comparative profitability of three proposals

Details	Show "Blood Bath" for second two weeks.	Show "Appu on the Airbus" for two weeks.	Show "Blood Bath" for another one week and "Appu on the Airbus" for the following week.
Attendance			
<i>Adults</i>			
First week		2,250	Rs 1,500
Second week		2,000	1,500
Total—Adults		4,250	3,000
			3,750

Children

First week	—	500	—
Second week	—	500	500
Total children	—	1,000	500
Grand total (Adults + children)	4,250	4,000	4,250

Earnings

(a) Sale of tickets			
—Adults @ Rs. 2.00	8,500	6,000	7,500
— Children @ Rs. 1.20	—	1,200	600
(b) Sale of eatables @ Rs. 1.20 per patron	5,100	4,800	5,100
Total earnings (a + b)	13,600	12,000	13,200

Incremental costs

Higher charges of "Blood Bath"	1,500	—	900
Cost of eatables (60% of selling price) i.e., @ Re. 0.72 per patron)	3,060	2,880	3,060
Total incremental cost	4,560	2,880	3,960
Incremental profit	9,040	9,120	9,240

Recommendations. It is seen from the above statement that the incremental profit is maximum when both the pictures are shown for one week. The Manager of the theatre should show "Blood Bath" for one week and "Appu on the Airbus" for next one week.

Working Notes :

1. *Attendance.* (a) First of all it should be noted that the theatre has been showing the picture "Blood Bath" for past two weeks. Now it is to be decided whether this picture has to be continued for another two weeks or another picture "Appu on the Airbus" to be shown during this period. The third alternative is to show each picture for one week only.

(b) It is given that attendance for 'Blood Bath' has been 50% greater than the normal total and this attendance will taper off during the second two weeks, 25% below that of the first two weeks, during the third week and 33½% below that of the first two weeks, during the fourth week.

The computation of attendance for 'Appu on the Airbus' is very simple. The workings showing attendance for "Blood Bath" are given below :

		<i>Third week</i>	<i>Fourth week</i>	<i>Total</i>
Blood Bath for 2 weeks (attendance 50% greater)				
Normal attendance Adults	2,000			
50% greater	1,000			
Total	3,000			
Less : Attendance 25% for 3rd week	750	2,250		
Fourth week (3,000 less 33½% for 4th week)			2,000	4,250

2. Rent for "Appu on the Airbus" is Rs. 750 for one week or Rs. 1,200 for two weeks. This item of expenditure is committed cost as the theatre has to pay rent on this picture even though it is not screened. This cost has not been taken into consideration in arriving at a decision.

3. Similarly another item of committed cost is operating cost of Rs. 4,200. This is also not relevant in the present decision.

Alternatives involving better packing, additional sales promotion, reduced S.P.

Problem 10'52. A review, made by the top management of Sweat and Struggle Ltd., which makes only one product, of the result of the first quarter of the year revealed the following :

Sales in units	10,000
Loss	Rs. 10,000
Fixed cost (for the year Rs. 1,20,000)	30,000
Variable cost per unit	8'00

The Finance Manager who feels perturbed suggests that the company should at least break-even in the second quarter with a drive for increased sales. Towards this, the company should introduce a better packing which will increase the cost by Re. 0'50 per unit.

The Sales Manager has an alternative proposal. For the second quarter additional sales promotion expenses can be increased to the extent of Rs. 5,000 and a profit of Rs. 5,000 can be aimed at during the period with increased sales.

The Production Manager feels otherwise. To improve the demand, the selling price per unit has to be reduced by 3%. As a result the sales volume can be increased to attain a profit level of Rs. 4,000 for the quarter.

The Managing Director asks you as a Cost Accountant to evaluate

the three proposals and calculate the additional sales volume that would be required in each case, in order to help him to take a decision.

(C.A. Inter, Nov. 1985)

Solution : Selling Price per unit for first quarter

Fixed cost	Rs. 30,000	
Less : Loss	10,000	
Contribution	20,000	
Contribution per unit	Rs. 2'00	(20,000 ÷ 10,000)
$S - V = \text{Contribution}$	or $S = \text{contribution} + V$	
$= \text{Rs. } 2'00 + 8'00$	or $\text{Rs. } 10'00$	

For second quarter : Finance Manager's Proposal

Revised variable cost	$= \text{Rs. } 8 + 0'50 = \text{Rs. } 8'50$
Revised contribution	$= \text{Rs. } 10 - 8'50 = \text{Rs. } 1'50$
Break-even point (units)	$= \text{Fixed cost} \div \text{contribution per unit}$
P/V ratio	$= \text{Rs. } 30,000 \div \text{Rs. } 1'50$
	$= 20,000 \text{ units.}$
	$= 15\%$

Therefore additional 10,000 units should be sold to break-even.

Sales Manager's Proposal

Present fixed cost	Rs. 30,000
Add : Sales promotion expenses	5,000
Revised fixed cost	35,000
Revised profit	5,000
Revised contribution	40,000
Revised sales volume	$= \text{Revised contribution} \div \text{contribution per unit}$ (first quarter)
P/V Ratio	$= 20\% = \text{Rs. } 40,000 \div \text{Rs. } 2$ or 20,000 units

In this case also, the additional sales volume of 10,000 units is required.

Production Manager's Proposal

Reduced selling price	$= \text{Rs. } 9'70$ (reduced by 3%)
Contribution per unit	$= \text{Rs. } 9'70 - \text{Rs. } 8'00$ or $\text{Rs. } 1'70$
Revised contribution	$= \text{Existing fixed cost} + \text{Revised profit}$
	$= \text{Rs. } 30,000 + \text{Rs. } 4,000$ or $\text{Rs. } 34,000$
Revised sales volume	$= \text{Revised contribution} \div \text{contribution per unit}$
P/V ratio	$= 17'52\% = \text{Rs. } 34,000 \div 1'70$ or 20,000 units

Additional sales volume required is 10,000 units.

The summary of profitability of the three proposals is as under :

	<i>Proposals</i>		
	<i>Finance Manager</i>	<i>Sales Manager</i>	<i>Production Manager</i>
P/V Ratio	15%	20%	17.52%
Net Profit	Nil	Rs. 5,000	Rs. 4,000

It is noticed that additional sales volume in all the three proposals is 10,000 units to achieve the desired objective. Therefore, sales volume does not affect the decision. The P/V ratio and Net profit of Sales Manager's proposal are the maximum and, therefore, this proposal should be accepted.

Utilization of dead stocks as substitute material or Sell as it is— Incremental approach

Problem 10.53. As a result of change in consumer preference the company of which you are the management accountant finds that certain materials in stock which were bought for Rs. 7,000 a few years ago have not moved for a long time. The current replacement price of these materials is Rs. 8,000. If these materials were disposed of by sale, they would fetch a net realisable value of Rs. 4,000 only.

The company has the opportunity of carrying out a one-time job (Job No. 101) which can utilise these materials and yield a revenue of Rs. 16,000. The additional costs, other than the cost of these materials, chargeable to this job will amount to Rs. 14,200. This charge includes the apportionment of general administration overheads amounting to Rs. 3,800, but the incurrence of all other expenses is dependent upon the execution of Job 101.

Alternatively, the materials in question could be used as a substitute for other materials in another regular Job (Job 208). The materials so replaced will otherwise cost Rs. 6,000. These costs have been included in the viability of Job 208 which is expected to yield an additional net benefit of Rs. 11,000.

The Company has thus three alternatives namely :

- (i) use of the material in Job 208 ;
- (ii) use the materials in Job 101 and carry out Job 208 by buying in the material required ; and
- (iii) sell the materials and carry out Job 208 by buying in the materials required.

You are required to :

- (a) State with reasons the costs which are irrelevant to the decision of alternative choices.
- (b) Evaluate the three alternatives given above by using the concepts of :

- (1) incremental cost and benefit analysis ;
- (2) opportunity cost and benefit analysis.
- (c) State which of the alternatives should be accepted by the Company. (I.C.W.A. Final, Dec. 1986)

Solution. (i) The following costs are irrelevant to the decisions of alternative choices :

(a) The materials worth Rs. 7,000 was bought a few years ago cannot be used for the original job. Therefore, materials amounting to Rs. 7,000 is the past cost which is irrelevant for cost and benefit analysis.

(b) Apportionment of general administration overheads amounting to Rs. 3,800 to one-time job number 101 is irrelevant as this amount represents fixed cost which cannot be considered relevant to the present analysis.

(c) Decision to use the materials as substitute in a regular job (Job 208). This is expected to yield an additional net benefit of Rs. 11,000. The undertaking of Job 208 (a regular job) is already committed and therefore, this cost is irrelevant to the analysis.

(b) (1) Incremental cost and benefit analysis

Any incremental cost and benefit analysis requires certain base to be used. For the present analysis, Job 208 is a regular job and the same has been used as a base for incremental cost and benefit analysis.

	<i>Execute Job 208</i>	<i>Use the materials in Job 101</i>	<i>Selling the existing materials</i>
Costs			
Cost of Job 101			
(additional cost less fixed overheads)—	Rs. 10,400	Rs. —	
Purchase of materials for Job 208 —	6,000	6,000	
	—	—	
Total costs	16,400	6,000	
	—	—	
Benefits			
Sale of existing material	—	4,000	
Revenue from Job 101	16,000	—	
	—	—	
Total benefits	16,000	4,000	
	—	—	
Net cost/benefit	(400)	(2,000)	
(In both the above alternatives the costs are more than the benefits).			
(2) Opportunity cost analysis			
Opportunity costs	—	10,400	—
Benefits (by using materials)	6,000	16,000	4,000
	—	—	—
Net benefit	6,000	5,600	4,000

(iii) As the benefit is maximum if the material is used in Job 208, it is advisable to use the materials in Job 208.

Continue a research project or abandon it

Problem 10-54. XYZ Ltd., has to date spent Rs. 75,000 on a research project and it expects that when completed in a further year the results of that research can be sold for Rs. 1,00,000. In trying to decide whether to proceed, the business identifies the additional expenses necessary to complete the research :

Materials. Rs. 30,000. This material (already in store and paid for) is very toxic and will have to be disposed of in sealed containers at a cost of Rs. 2,500.

Labour. Rs. 20,000. The research project uses highly skilled labour taken from the production department of the company. If they were working on normal production, the company could earn Rs. 25,000 additional contribution to profit in the next year after paying the skilled labour.

Research staff. Rs. 30,000. The research unit will close down after the project has been completed and voluntary retirement pay has already been agreed at Rs. 12,500.

General overheads. Rs. 20,000. The research unit is apportioned a share of the total fixed costs of the business.

The Management Accountant of the Company has presented the following analysis and recommended against continuation, since the analysis shows that the company would lose Rs. 25,000 more by continuing the project than by abandoning now.

The Managing Director seeks your opinion as the group Management Accountant about the analysis presented by the Management Accountant.

	<i>Abandon now</i>		<i>Complete</i>
	—		Rs. 1,00,000
Sales			
Costs to date	Rs. 75,000	Rs 75,000	
Additional costs :			
Materials		30,000	
Labour		20,000	
Research staff		30,000	
Overheads		20,000	
Loss in contribution		25,000	2,00,000
Net loss	75,000		1,00,000

(J.C.W.A. Final, Dec. 1986)

Solution. The analysis presented by the Management Accountant

does not speak about his expertise in presenting decision-making data. He has not considered the sunk cost, relevant and irrelevant cost and opportunity cost concepts. The conclusions drawn by the Management Accountant are incorrect due to the following reasons :

(i) The company has already spent Rs. 75,000 on a research project. The company cannot retrieve the amount already spent, if the company discontinues the project. It is a sunk cost, and irrelevant for decision making.

(ii) The material worth Rs. 30,000 purchased in the past is still lying in store and it has no substitute use. Thus Rs. 30,000 is again sunk cost and the same cannot be considered for decision analysis. The amount of Rs. 2,500 spent on disposing of it will have to be taken into consideration.

(iii) If the research project is abandoned, labour cost of Rs. 20,000 is not relevant as the same will be used by production department. If the research project is continued, it is necessary to consider the contribution foregone (opportunity cost of Rs. 25,000) plus Rs. 20,000 labour cost to be paid by research department.

(iv) Salaries of research staff will be saved if the research project is abandoned. This is relevant to this decision. The voluntary retirement pay has already been agreed and it forms part of sunk cost and, therefore, it is irrelevant to this decision analysis.

(v) Apportionment of general heads to research project is irrelevant as it is a fixed overhead. This cost will continue to be incurred by the production department irrespective of whether the research project is continued or not. The correct analysis is given below :

Statement showing relevant cost of continuing or discontinuing the research project

	<i>Abandon the project</i>	<i>Complete the project</i>
Sale proceeds from research	—	Rs. 1,00,000
Relevant costs		
Disposal cost of material	Rs. 2,500	
Labour (Rs. 25,000 + Rs. 20,000)	—	45,000
Research staff cost	—	30,000
Total cost	2,500	75,000
Profit/(Loss)	(2,500)	25,000

If the project is abandoned, the company's loss will be Rs. 2,500. However, if the research project is completed, the company will earn a profit of Rs. 25,000. Therefore, company should continue the project.

Cost benefit analysis of increased advertisement expenditure, fixed production and marketing overheads

Problem 10-55 Mic Ltd., standard product has the following marginal cost :

Direct materials	Rs.	160'00
Direct wages		120'00
Variable production overhead		20'00
		<hr/>
		300'00
		<hr/>

Its annual budget includes the following :

Output	80,000 units
Fixed overhead :	Rs.
Production	1,60,00,000
Administration	96,00,000
Marketing	80,00,000
Contribution	4,00,00,000

Management is not satisfied with the budget prepared and the results likely to follow. In the course of a discussion at the Board meeting, possible strategies to improve the situation and the following ideas were put forward :

(1) The Managing Director seeks a profit of Rs. 96,00,000. He wants to know the selling price required to achieve this, if it is estimated that :

(a) an increase in advertising expenditure of Rs. 18,88,000 would bring in a 10% increase in sales ; and

(b) fixed production overhead would increase by Rs. 4,00,000 and marketing overhead by Rs. 2,72,000.

(2) The marketing director suggested that with an additional advertising expenditure, sales would increase by 20% and a profit on turnover of 15% obtained. In the circumstances, fixed production overhead would increase by Rs. 6,40,000 and marketing overhead by Rs. 4,00,000. You have to find out and fix up the possible additional expenditure on advertising so as to achieve the results.

(3) The Chairman has in hand an order from a departmental store to supply on a long-term contract 20,000 units per annum at a special discount. Existing sales would not be affected and fixed production overhead would increase by Rs. 6,00,000 per annum. How much special discount could be given if by accepting the contract the profit of the company were to be increased to Rs. 1,08,00,000 per annum ?

You as the management accountant are required to draw up a forecast profit statement for the year for each of the proposals stated and comment briefly on each.

(I.C.W.A. Final, December 1985)

Solution : **Forecast profit statement for the year for each of the proposal**

	<i>Present proposal</i>	<i>Proposal 1</i>	<i>Proposal 2</i>	<i>Proposal 3</i>
Sales units (Given)	80,000	88,000	96,000	1,00,000
Sales receipt (Refer to Note No. 1)	Rs. '000 64,000	Rs. '000 72,160	Rs. '000 76,800	Rs. '000 75,000
Less : Variable cost	24,000	26,400	28,800	30,000
Contribution	40,000	45,760	48,000	45,000
Less : Fixed cost (Refer to Note No. 2)	33,600	36,160	36,480	32,200
Profit	6,400	9,600	11,520	10,800

Comment :

(1) **Proposal No. 1** suggests an increase in advertisement expenditure by Rs. 18,88,000, an increase in production overhead by Rs. 4,00,000 and an increase of Rs. 2,72,000 in marketing overhead to earn a profit of Rs. 96,00,000. This will necessitate increase of price from Rs. 800 to Rs. 820. The proposal suggests increase in cost and increase in selling price simultaneously. Therefore, management must be careful in accepting this proposal, which seems to be risky, because sales volume is expected to rise by increase in selling price.

(2) **Proposal No. 2.** This proposal suggests an increase in production overhead by Rs. 6,40,000. Marketing overhead is expected to rise by Rs. 4,00,000. Advertisement expenditure is expected to be Rs. 18,40,000. Sales is expected to rise by 20%, without decrease in selling price. Therefore, the management has to be careful in accepting this proposal as well

(3) **Proposal No. 3.** Under this proposal additional sales of 20,000 units is expected to be for Rs. 1,10,00,000 i.e., Rs. 550 per unit. Under this proposal profit is more as compared to proposal 1, but, it is less in comparison to proposal 2.

Keeping in view all the proposals, proposal II seems to be the best,

because it leads to maximum profit, but caution should be exercised in accepting this proposal. It expects increase in sales volume with increase in cost.

Working Notes :

1. Sales under different alternatives :

(a) Present sales

	(Rs.)
Variable materials ($160 \times 80,000$)	1,28,00,000
Direct wages ($120 \times 80,000$)	96,00,000
Variable production overhead ($20 \times 80,000$)	16,00,000
	<hr/>
	2,40,00,000
Contribution (Given)	4,00,00,000
	<hr/>
	6,40,00,000
	<hr/>

Selling price per unit ($6,40,00,000 \div 80,000$) Rs. 800

(b) Proposal No. 1 :

Fixed (cost given)

	(Rs.)
Production	1,60,00,000
Administration	96,00,000
Marketing	80,00,000
	<hr/>
	3,36,00,000

Add : Increase in :

Advertising expenditure	18,88,000
Production	4,00,000
Marketing	2,72,000
	<hr/>

Revised fixed cost 3,16,00,000

Add : Profit 96,00,000

Revised contribution 4,57,60,000

Variable cost ($88,000 \times 300$) 2,64,00,000

Sales (under proposal 1) 7,21,60,000

Price per unit ($7,21,60,000 \div 88,000$) Rs. 820

(c) Proposal No. 2 :

Present sales

80,000 units

Add : 20%

16,000 units

96,000 units

Total sales under proposal 2 ($96,000 \times 800$) Rs. 7,68,00,000

(d) Proposal No. 3 :

<i>Fixed cost</i>	Rs.
Production	1,60,00,000
Administration	96,00,000
Marketing	80,00,000
	<hr/>
	3,36,00,000
 <i>Proposed increase</i>	
Production	0,00,000
	<hr/>
Revised fixed cost for this alternative	3,42,00,000
Profit desired	1,08,00,000
	<hr/>
Total contribution desired	4,50,00,000
Variable cost (1,00,000 × 300)	3,00,00,000
	<hr/>
Total sales for this proposal	7,50,00,000
Less : Sales 80,000 units at normal selling price (80,000 × 100)	6,40,00,000
	<hr/>
Price at which additional order of 20,000 units can be sold	1,10,00,000
	<hr/>
Normal price for 22,000 units (20,000 units × 800)	16,00,00,000
Price at which it can be sold	11,00,00,000
	<hr/>
Special discount	5,00,00,000
	<hr/>

Note No. 2 ;

<i>Fixed cost present</i>	
Production	1,60,00,000
Administration	96,00,000
Marketing	80,00,000
	<hr/>
	3,36,00,000
	<hr/>

Proposal No. 1 :

Production		
Present	1,60,00,000	
Addition	4,00,000	1,64,00,000
	<hr/>	

DECISION MAKING**P10129**

Administration		
Marketing Present	80,00,000	'96,00,000
Addition	2,72,000	
Advertisement	18,88,000	1,01,60,000
		<u>3,61,60,000</u>

Proposal No. 2 :

Production		
Present	1,60,00,000	
Addition	6,40,000	1,66,40,000
		<u>1,66,40,000</u>
Administration		
Marketing present	80,00,000	96,00,000
Addition	4,00,000	
Advertisement @	18,40,000	1,02,40,000
		<u>3,64,80,000</u>

Working is given below :

Sales under this proposal as per Note 1 (e)	Rs.	7,68,00,000
Less : Variable cost (96,000 × Rs. 300)		<u>2,88,00,000</u>

Contribution required 4,80,00,000

Less : (known elements of contribution)

Profit required

$$\left(\frac{7,68,00,000 \times 15}{100} \right) = 1,15,20,000$$

Fixed cost production (Refer to
Note No. 2)

Fixed cost production (Refer to Note No. 2)	1,66,40,000	
Administration	96,00,000	
Marketing	84,00,000	4,61,60,000
		<u>4,61,60,000</u>

@ Administration expenses on advertising so as to achieve
the result18,40,000**Proposal No. 3 :**

Production		
Present	1,60,00,000	
Additional	6,00,000	1,66,00,000
		<u>1,66,00,000</u>
Administration		
Marketing		96,00,000
		<u>80,00,000</u>
		<u>3,42,00,000</u>

Division-wise profitability due to imports—usage of substitute and revised production programme

Problem 10-56. Vinak Ltd., has two manufacturing divisions, *AD* and *CD*. Each division operates as an independent profit centre.

AD which produces two components **BRITE** and **LITE** has a capacity of 1,00,000 hours per annum. The annual fixed overheads of this department amounts to Rs. 20 lacs. The productwise variable cost data are as under :

	<i>BRITE</i> Rs./unit	<i>LITE</i> Rs./unit
Direct materials	10	5
Direct labour and variable overheads	140	35
Total	150	40

The direct labour and variable overhead rate is Rs. 35 per hour.

AD has a permanent customer for the purchase of 15,000 units of **BRITE** per annum at a selling price of Rs. 300 per unit. The balance capacity is devoted to the production of **LITE** for which there is an unlimited sales potential at Rs. 60 per unit.

CD assembles a product known as **TITE** by using an imported component. The annual fixed overheads of this division amount to Rs. 4 lacs and the variable cost data per unit are as under :

	<i>TITE</i> Rs./units
Imported component	300
Direct materials	40
Direct labour and variable overheads 10 hours @ Rs. 25	250
Total	590

The selling price of **TITE** is Rs. 700 per unit.

With a view to minimise the dependence on imported components, the possibility of using the company's own component **BRITE**, which is similar to the imported component, was explored. The import substitution is possible with slight modification in the manufacture of **TITE** which in that case will take two extra labour hours per unit. This means an increase of Rs. 50 in variable costs per unit of **TITE**, *CD* envisages a production of 5,000 units per annum of **TITE**.

You are required to present the divisionwise profitability and the profitability of the company as a whole on the basis of the following conditions :

(i) CD imports its requirement of 5,000 components for the manufacture of TITE.

(ii) CD Stops import and substitutes BRITE by drawing 5,000 units of BRITE from AD at the market price of Rs. 300 per unit.

(iii) Same situation as in (ii) above except that CD gets a relief of Rs. 50 per unit (net transfer price to CD is Rs. 250 per unit) of BRITE to compensate the increased labour and variable overhead cost of CD.

(iv) CD revises its production programme to manufacture 12,000 units of TITE by drawing 10,000 units of BRITE from AD at Rs. 250 per unit and imports the balance of 2,000 units of components at Rs. 300 per unit. Due to installation of additional production capacity, the annual fixed overhead of CD would increase by Rs. 7,70,000. In order to induce CD to the expansion programme do you think a negotiated transfer price of Rs. 240 for BRITE would be agreed by AD? Give reasons and also comment on the best alternative (i) to (iv) for the company as a whole.

(I.C.W.A. Final, June 1987)

Solution : Profitability statement when :

(i) CD imports 5,000 required components @ Rs. 300 :

(Rupees)

Divisions→ Products	AD		CD
	Brite	Lite	Tite
Contribution per unit			
Sale price	300	60	700
Less : Variable cost			
Imported component	—	—	300
Direct material	10	5	40
Direct labour/variable overhead	140	35	250
Contribution per unit (a)	150	20	110
*No. of units (b)	15,000	40,000	5,000
Total contribution (a) and (b)	22,50,000	8,00,000	5,50,000
	(30,50,000)		5,50,000
Less : Fixed cost	20,00,000		4,00,000
Profit	10,50,000		1,50,000

Total profit for company = Rs. 10,50,000 + 1,50,000 = Rs. 12,00,000.

*No. of units

Hours required for one unit = $\frac{\text{Direct labour and variable overhead}}{\text{Direct labour and overhead rate}}$

<i>Brite</i>	<i>Lite</i>
$140 \div 35$	$35 \div 35$
4 hours	1 hour

AD supplies 15,300 units of Brite to permanent supplier so $15,000 \times 4 = 60,000$ hours will be exhausted. Total capacity of AD = 1,00,000 hours.

Remaining capacity = $1,00,000 - 60,000$ or 40,000 hours

Production of Lite = $40,000/1$ or 40,000 units.

(ii) when CD draws 5,000 units of Brite from AD at Rs. 300 :

(Rupees)

Divisions→ Products	AD		CD
	Brite	Lite	Lite
Units produced	20,000	20,000	5,000
Per Unit			
Sale price	300	60	700
Less : Variable cost :			
Material	10	5	340
Labour and variable overhead	140	35	300*
	<u>150</u>	<u>20</u>	<u>60</u>
Contribution/Units	30,00,000	4,00,000	3,00,000
Total contribution (Per unit × No. of units)	34,00,000		
Less : Fixed cost	20,00,000		4,00,000
Profit (Loss) per division	14,00,000		(1,00,000)

Company's total profit = Rs. 13,00,000.

* Existing labour and variable overhead Rs. 250 + Rs. 50 increase in variable cost.

Units produced of Lite.

Brite's production of 20,000 units will exhaust $20,000 \times 4 = 80,000$ hours of AD. Rest of 20,000 hours will be used to produce 20,000 units of Lite at the rate of one unit per hour.

(iii) Transfer price of Brite from AD to CD is fixed at Rs. 250.

(Rupees)

Divisions	AD			CD
	Brite		Lite	Tite
Units	Perma- nent customer 15,000	CD 5,000	20,000	5,000
Per Unit :				
Sale price	300	250	60	700
Less : Variable cost				
Direct material	10	10	5	290
Direct labour/Var. overhead	140	140	35	300
Contribution per unit	150	100	20	110
Total contribution	22,50,000	5,00,000	4,00,000	5,50,000
		31,50,000		
Less : Fixed cost		20,00,000		4,00,000
		11,50,000		1,50,000

Company's profit = Rs. 13,00,000

(iv) CD manufactures 12,000 and AD transfers to CD 10,000 units :

(Rupees)

Divisions	AD		CD	
	Brite		Tite (12,000)	
Units	Perma- nent customer 15,000	CD 10,000	Input from AD 10,000	Import 2,000
Per Unit				
Sale price	300	250	700	700
Less : Variable cost				
Material	10	10	290	340
Labour and Variable overhead	140	140	300	250
Contribution/Unit	150	100	110	110

Total contribution	22,50,000 | 10,00,000	11,00,000 | 2,20,000
	<u>32,50,000</u>	<u>13,20,000</u>
Less : Fixed cost	20,00,000	11,70,000
	<u>12,50,000</u>	<u>1,50,000</u>
	=====	=====

Company profit = Rs. 14,00,000.
=====

Recommendation on best alternative

Alternative (iv) seems to be the best because it leads to the maximum profit of Rs. 14,00,000 for the company. But management should consider that whether stopping the production of Lite altogether will, in any way, be detrimental to company's interests.

Negotiated price of Rs. 240 per unit

The price of Rs. 240 per unit will be acceptable to AD because it will lead to a contribution of Rs. 22 50 per hour, i.e., (Rs 240—Rs. 150) ÷ 4 hours. If this proposal is not accepted AD will have to produce Lite which will yield a contribution of only Rs. 20 per hour, i.e., (Rs. 60—Rs. 40) ÷ 1 hour.

Overall profitability arising out of discontinuation of a product, utilizing idle capacity for exports and hiring out idle capacity

Problem 10 57 G Ltd, has prepared the following budget estimates for 1987-88

Sales (units)	Product A 6,000 Rs./unit	Product B 16,000 Rs./unit
Selling price	40	64
Direct materials	12	22
Direct wages @ Re. 1 per hour	8	12
Variable overheads	4	6
Fixed overheads	8	12
Total	32	52
Profit	8	12

After the finalisation of the above manufacturing programme, it is observed that *one-third capacity* of the company is still idle. In order to improve the working the following proposals are put up for consideration:

(i) Discontinue Product 'A' and the capacity so released will be used on Product 'B'. The selling price of Product 'B' however will be reduced by Rs. 2 per unit on the entire sales due to increased volume of sales.

(ii) Discontinue Product 'B' and divert the capacity so released to the production of Product 'C' whose unit cost data are as under :

Selling price	Rs. 52
Direct material	Rs. 15
Direct labour	Rs. 10
Variable overheads	Rs. 5

(iii) Utilise the idle capacity for meeting an export demand for Product 'D' whose unit cost data are as under :

Selling price	Rs. 72
Direct materials	Rs. 40
Direct labour	Rs. 20
Variable overheads	Rs. 10

(iv) Hire out the idle capacity hours by fixing a price in such a way that the same rate of profit per direct labour hour as obtained in the original budget estimates is achieved. Indicate the hire charges per direct labour hour. Required :

(a) Prepare a statement showing the profitability as envisaged in the original programme

(b) Evaluate each of the above four proposals independently and present statements showing overall profitability under each proposal

(I.C.W.A. Final, June 1987)

Solution.

	A	B
Labour hour per unit	8/1 = 8 hours	12/1 = 12 hours
No. of units	6,000	16,000
Labour hours utilised	48,000	1,92,000
Total labour hours as per budget	= 48,000 + 1,92,000 = 2,40,000 hours.	
Idle capacity	= 2,40,000 × 3/2 × 1/3 = 1,20,000 hours	
Fixed overhead rate	= Rs. 8 for 8 hours or Rs. 12 for 12 hours	
	= Re. 1 per hour	
Total fixed cost	= (6,000 × 8) + (16,000 × 12)	
	= 48,000 + 1,92,000 = 2,40,000.	

(a) **Profitability statement—Original programme**

Product	A	B
Units	6,000	16,000
Cost per unit :		
Sale price	Rs. 40	Rs. 64
Less : Variable cost :		
Direct material	12	22
Direct wages	8	12
V. overhead	4	6
Contribution per unit	16	24
Total contribution	96,000	3,84,000
Less : Fixed cost	4,80,000	
	2,40,000	
Profit	2,40,000	

(b) Proposal I

Capacity released by discontinuing A = 48,000 hours

Released capacity will produce B $48,000/12=4,000$ units

Therefore, production will be A—Nil B—20,000 units

Profitability statement

<i>Particulars</i>		<i>B—20,000 units</i>
<i>Contribution per unit :</i>		
		62
Less : Variable cost :		
Direct material	22	
Direct wages	12	
Variable overhead	6	40
	—	—
Contribution		22
		—
Total contribution (22 × 20,000)		4,40,000
Less : Fixed cost		2,40,000
		—
Profit		2,00,000

Proposal II

Discontinuing B will release 16,000 × 12 = 1,92,000 hours Assuming labour rate to be the same for C, i.e., Re 1 per labour hour, one unit of C takes 10 hours.

Therefore the production of C = 1,92,000 hours/10 = 19,200 units

Profitability statement

<i>Particulars</i>	<i>Product 'A'</i> <i>(6,000 units)</i>	<i>Product 'C'</i> <i>(19,200 units)</i>
<i>Contribution per unit :</i>		
	40	52
Less : Variable cost		
Direct material	12	15
Direct labour	8	10
Variable overheads	4	5
	—	—
Contribution per unit	16	22
	—	—
Total contribution	96,000	4,22,400
		—
Less : Fixed cost		5,18,400
		2,40,000
		—
Profit		2,78,400
		—

Proposal III. Introducing product D for export purpose

Particulars	A 6,000 units	B 16,000 units	D 6,000
Contribution per unit :			
Selling price	40	64	72
Less : Variable cost :			
Direct material	12	22	40
Direct labour	8	12	20
Direct overhead	4	6	10
Contribution per unit	16	24	2
Total contribution	96,000	3,84,000	12,000
		4,92,000	
Less : Fixed cost		2,40,000	
Profit		2,52,000	

Proposal IV : Hiring out the idle capacity

Profit as per original programme [Refer to (a)]	Rs. 2,40,000
Labour hours as per original programme	2,40,000 hours
Profit per labour hour	= Re. 1
Idle labour hours	1,20,000
Addition to the profit by renting out the idle capacity 1,20,000 × Re. 1	= Rs. 1,20,000
Original profit	2,40,000
Total profit after hiring out idle capacity	3,60,000

Recommendation. Proposal IV is recommended since it yields the maximum profit.

Purchase from outside or sub-contracting (Full capacity situation)

Problem 10 58. A processing company, EF, is extremely busy. It has increased its output and sales from 12,900 kg. in quarter 1 to 17,300 kg. in quarter 2 but, though demand is still rising, it cannot increase its output more than another 5% from its existing labour force which is now at its maximum.

Data in quarter 2 for its four products were :

Product	P	Q	R	S
Output (kg.)	4,560	6,960	3,480	2,300
		Rs. per kg.		
Selling price	16.20	11.64	9.92	13.68

Costs :

Direct labour (at Rs. 6 per hour)	1'96	1'30	0'99	1'70
Direct materials	6'52	4'90	4'10	5'42
Direct packaging	0'84	0'74	0'56	0'70
Fixed overhead (absorbed on basis of direct labour cost)	3'92	2'60	1'98	3'40
Total	13'24	9'54	7'63	11'22

The XY Company has offered to supply 2,000 kg. of product Q at a delivered price of 90% of EF's selling price. The company will then be able to produce extra product P in its place up to the plant's total capacity.

You are required to state, with supporting calculations :

(a) whether EF should accept the XY Company's offer ;

(b) which would be the most profitable combination of sub-contracting 2,000 kgs. of one product at a price of 90% of its selling price and producing extra quantities of another product up to the plant's total capacity. Assume that the market can absorb the extra output and that XY's quality and delivery are acceptable.

(I.C.M.A. London, Nov. 1986—Adapted I.C.W.A. Final June 1989—Similar)

Solution :

Step 1. Contribution per kg. for different products

Products	S.P. per kg.	V. cost per kg.	Contribution per kg.
P	Rs. 16'20	Rs. 9'32	Rs. 6'88
Q	11'64	6'94	4'70
R	9'92	5'65	4'27
S	13'68	7'82	5'86

Step 2. Capacity still to be used for P

Products	Output kg.	D.L. per kg.	Total Remuneration
P	4,560	Rs. 1'96	Rs. 8937'60
Q	6,960	1'30	9048'00
R	3,480	0'99	3445'20
S	2,300	1'70	3910'00
			25340'80

∴ labour getting following remuneration will be available for use for P = Rs. 25340'80 × 5% = Rs. 1,267.

If this labour is used for P, the output increase of P in kg. will be = Rs. 1,267 ÷ Rs. 1'96 = 646 kg.

Step 3. Output increase in P if Q is subcontracted

Labour getting following remuneration will be available for P
 $2,000 \text{ kg.} \times \text{Rs. } 1.30 = \text{Rs. } 2,600$

Output increase of P for this reason $= \text{Rs. } 2,600 \div \text{Rs. } 1.96$
 $= 1,327 \text{ kg.}$

(a) Total increase in output of P, if Q is subcontracted

(a) Output increase due to use of available labour by subcontracting Q (Step 3)	1,327 kg.
(b) 5% increase in existing labour force (step 2)	646 kg.
	<u>1,973 kg.</u>

Contribution gain for product P by subcontracting Q
 $1,973 \text{ kg.} \times \text{Rs. } 6.88 = \text{Rs. } 13,574.24$

Contribution lost :

Contribution by producing 2,000 units of Q before subcontracting $(2,000 \text{ kg.} \times \text{Rs. } 4.70)$	$= \text{Rs. } 9,400$	
Less : Contribution which company will still make after subcontracting $2,000 \text{ kg.} \times (\text{Rs. } 11.64 - 90\% \text{ of } 11.64) =$	2,328	7,072.00
Extra contribution		<u>6,502.24</u>

\therefore It is in the interest of company to accept XY's offer to supply 2,000 kg. of product Q and make 1,973 kg. extra product P to gain Rs. 6,502.24.

(b)	Contribution lost Rs.	Contribution gained Rs.	Differential gain Rs.
A. If P is subcontracted :			
Contribution lost will be 2,000 kg. \times (Rs. 6.88 - Rs. 1.62)	10,520		
Labour getting following remuneration will be available :			
2,000 kg. \times Rs. 1.96	$= \text{Rs. } 3,920$		
5% increase from existing labour (Step 2)	$= \text{Rs. } 1,267$		
	<u>5,187</u>		

	Contri- bution lost Rs.	Contri- bution gained Rs.	Differen- tial gain Rs.
Labour getting Rs. 5 187 can be utilized for producing Q, R and S.			
(i) If utilized for Q Rs. $5,187 \div 1.30 \times 4.70$, i.e., contribution per kg.		18,753*	8,233
(ii) If utilized for R : Rs. $5,187 \div 0.99 \times 4.27$, i.e., contribution per kg.		22,372*	11,852
(iii) If utilised for S : Rs. $5,187 \div 1.70 \times 5.86$, i.e., contribution per kg.		17,879*	7,359
* Rs. 10,520 deducted to find differential gain			
B. If Q is subcontracted			
Contribution lost will be :			
2,000 kg. \times (Rs. 4.70 - Rs. 1.164)	7,072		
Labour getting following remuneration will be available			
2,000 kg. \times Rs. 1.30	= Rs. 2,600		
5% increase from existing labour (Step 2)	— 1,267		
	<u>3,867</u>		
Labour getting Rs. 3,867 can be utilized for P, R and S.			
(i) If utilised for P :			
Rs. $3,867 \div 1.96 \times Rs. 6.88$, i.e., contribution per kg.		13,573†	6,501
(ii) If utilised for R :			
Rs. $3,867 \div 0.99 \times Rs. 4.27$, i.e., contribution per kg.		16,678†	9,606
(iii) If utilised for S :			
Rs. $3,867 \div 1.70 \times Rs. 5.86$, i.e., contribution per kg.		13,329†	6,257
Rs 7,072 deducted to find differential gain.			

	Contri- bution lost. Rs.	Contri- bution gained Rs.	Differ- ential gain Rs.
C. If R is subcontracted			
Contribution lost will be :			
2,000 kg. \times (Rs. 4.27—Rs. 0.992)	6,556		
Labour getting following remuneration will be available			
2,000 kg. \times Re. 0.99	= Rs. 1,980		
5% increase from existing labour (Step 2)	= 1,267		
	<u>3,247</u>		
Labour getting Rs. 3,247 can be utilised for producing P, Q and S.			
(i) If utilised for Q			
Rs. 3,247 \div 1.96 \times Rs. 6.88, i.e., contri- bution per kg.		11,397*	4,841
(ii) If utilized for Q			
Rs. 3,247 \div 1.30 \times Rs. 4.70, i.e., contri- bution per kg.		11,739*	5,183
(iii) If utilized for S			
Rs. 3,247 \div 1.70 \times Rs. 5.86, i.e., contri- bution per kg.		11,192*	4,636
Rs. 6,556 deducted to find differential gain.			
(d) If S is Subcontracted			
Contribution lost will be :			
2,000 kg. \times (Rs. 5.86—Rs. 1.368)	8,984		
Labour getting following remuneration will be available for use			
2,000 kg. \times Rs. 1.70	Rs. 3,400		
5% increase from existing labour (Refer to step 2)	1,267		
	<u>4,667</u>		

	Contri- bution lost Rs.	Contri- bution gained Rs.	Differen- tial gain Rs.
Labour getting Rs. 4,667 can be utilized for P, Q and R.			
(i) <i>If utilised for P :</i>			
Rs. $4,667 \div 1.96 \times$ Rs. 6.88, i.e., contri- bution per kg.		16,382✓	7,398
(ii) <i>If utilised for Q</i>			
Rs. $4,667 \div 1.30 \times$ Rs. 4.70, i.e., contri- bution per kg.		16,873✓	7,889
(iii) <i>If utilised for R :</i>			
Rs. $4,667 \div 0.99 \times$ Rs. 4.27, i.e., contri- bution per kg.		20,129✓	11,145
✓ Rs. 8,984 deducted to find differential gain			

From the review of column 3 "differential gain", it becomes clear that maximum gain of Rs 11,852 will be realised, if P is subcontracted and additional quantity of R ($5,187 \div 0.99$, i.e., 5,239 kg.) is produced.

Cost benefit analysis of improved packing, special reduced price and increased advertisement

Problem 10.59 Better and Better Ltd., manufactures only one product. Production is regular throughout the year and the capacity of the factory is 1,50,000 units per annum. The summarised Profit and Loss Account for the year as under was submitted at a Board Meeting :

Sales @ Rs. 10 per unit	Rs. 10,00,000
Cost of Sales :	
Direct materials	2,50,000
Direct labour	1,50,000
Production overhead :	
Variable	50,000
Fixed	2,20,000
Administration overhead :	
Fixed	1,00,000
Selling and distribution overhead :	
Variable	40,000
Fixed	1,60,000
Profit	50,000

(i) The Chairman felt that the packaging of the product required improvement. He wanted to know the sales required to earn a target profit of 10% on turnover with the introduction of an improved packing at an additional cost of 30 paise per unit.

(ii) The Managing Director conveyed to the Board that a large retailer was interested to take a regular order of 30,000 units per annum at a special price. This would in no way affect the volume or price of the regular sales of the company. No selling and distribution costs would be incurred on this score because the retailer was prepared to collect the product from the factory warehouse at regular intervals. Only a special packing would be required for display purposes and this would cost an additional 20 paise per unit. He wanted to know for his own information the price per unit at which the special order would break-even and the price for quoting purposes, providing a contribution of Rs. 50,000.

(iii) The Sales Director proposed that he should be allowed to increase advertising by Rs. 2,40,000 and simultaneously increase the price of the product by 20%. He expected that he would then be able to increase sales from 1,00,000 units to 1,20,000 units per annum.

(iv) On the other hand, the Production Director opined that the selling price of the product should be reduced from Rs. 10 to Rs. 9 per unit in order to reach a wider sales market and thus to achieve full utilisation of the production resources.

(v) The Finance Director intervened to say that an aggressive advertisement campaign was the answer. He wondered how much that would cost if it were to increase the sales to 1,40,000 units per annum, yielding a profit of 10 per cent on turnover.

(vi) The Personnel Director pleaded for a change in the method of wage remuneration. At present, direct labour was paid a piece rate of Rs. 1.50 per unit. If a group bonus scheme were introduced, the output would be better. The proposal was to set a target of 2,000 units per week throughout the company's 50 week year. For each 2 per cent increase in production, there would be an increase of 1 per cent on the basic wages of each employee. No employee would suffer a reduction in basic wages. It was forecast that if the selling price were increased by 10 per cent and advertising were increased by Rs. 1,50,000, sales of 1,20,000 units per annum would be achieved.

You are required to evaluate individually the proposals of each of the members of the Board and give your recommendations.

(I.C.W.A. Final, June 1985)

Solution :

Existing position

Sales volume (units)

1,00,000

Selling price per unit	Rs. 10.00
Variable cost (2.50 + 1.50 + 0.30 + 0.40)	4.70
Contribution	5.30
P/V ratio	53%
Total contribution	Rs. 5,30,000
Fixed cost	4,80,000
Profit	50,000

(i) Selling price per unit	Rs. 10.00
Revised variable cost (Rs. 4.70 + 0.30)	5.00

Cost. per unit 5.00

P/V ratio = 50%

Target profit = 10% on sales

Sales × P/V Ratio = Fixed costs + profit

or $S \times 50\% = \text{Rs. } 4,80,000 + 10\% \text{ of } S$

$$S = \frac{4,80,000 + 10\% \text{ of } S}{50\%} \quad \text{or} \quad 50\% \text{ of } S - 10\% \text{ of } S = 4,80,000$$

$$\text{or } S = \frac{\text{Rs. } 4,80,000}{40\%} \quad \text{or} \quad \text{Rs. } 12,00,000 \quad \text{or} \quad 1,20,000 \text{ units}$$

(ii) Variable cost per unit	Rs. 4.70
Less : Variable selling and distribution expense	0.40

4.30

Add : Variable cost for special packing 0.20

Revised variable cost 4.50

Contribution required per unit (50,000 ÷ 30,000) 1.67

Price to be quoted 6.17

Total profit will be (50,000 + 50,000) Rs. 1,00,000

(iii) Revised sales volume	1,20,000 units
----------------------------	----------------

Revised selling price per unit (10 + 20% of Rs. 10) Rs. 12.00

Variable costs 4.70

Contribution per unit 7.30

Total contribution	Rs. 8,76,000
Less : Fixed cost (4,80,000 + 2,40,000)	7,20,000
Net profit	1,56,000
(iv) Sales volume (at 100% capacity)	1,50,000 units
Contribution per unit (Rs. 9—4·70)	4·30
Total contribution (1,50,000 × 4·30)	Rs 6,45,000
Less : Fixed cost	4,80,000
Net profit	1,65,000
(v) Sales volume	1,40,000 units
Contribution per unit (Rs. 10—4·70)	Rs. 5·30
Total contribution (1,40,000 × 5·30)	7,42,000
Less : Profit (10% of Rs. 14,00,000)	1,40,000
	6,02,000
Less : Fixed costs	4,80,000
Amount available for advertisement	1,22,000
(vi) Revised production and sales	1,20,000 units
Existing	1,00,000
	20,000
% increase over the existing	20%
It is given that for each 2% increase in production, there would be 1% increase in basic wage. Therefore, for 20% increase in production, there will be 10% increase in basic wage.	
Piece Rate	Rs. 1·50 per unit
10% increase	10% of 1·50 or Re. 0·15
Existing variable cost per unit	4·70
Add : Increase wages (10%)	0·15
Revised variable cost	4·85
Revised selling price (10% increase)	11·00
Contribution per unit	6·15

Total contribution ($1,20,000 \times 6.15$)	Rs. 7,38,000
Less : Fixed costs ($1,80,000 + 1,50,000$)	6,30,000
Net profit	<u>1,08,000</u>

Recommendation : Proposal (iv) is recommended as it gives a profit of Rs. 1,65,000, which is highest amongst these alternatives.

Problem 10-60. (Alternative use of available capacity) Vinak Electronics Ltd., produces product 'A' for which the company has an assured market. The output for 19X1 has been budgeted at 1,20,000 units at 92% capacity utilisation. The cost sheet based on this output is as under :

Selling Price	Rs. 100
Direct Materials	21
Component 'X'	9
Direct wages @ Rs. 5 per hour	20
Factory overheads (50% fixed)	24
Selling & distribution overheads (75% variable)	12
Administration overheads	4
Total Costs	<u>90</u>

The factory overheads are applied on the basis of direct labour hours.

The Board was of the view that steps should be taken to utilise the idle capacity to improve the profitability of the company. The following proposals were accordingly put up before the Board for consideration :

(i) An order has been received from abroad for the export of 500 units of Product B per month at Rs. 120 per unit. The cost data are : direct materials Rs. 40 per unit, Direct Labour 8 hours per unit, selling and distribution overheads applicable to this product order is Rs. 10 per unit and the variable factory overheads are chargeable on the basis of direct labour hours.

(ii) The Company at present manufactures component 'X', one unit of which is required for each unit of Product 'A'. The cost details for 10,000 units of component 'X' are as under :

Direct Materials	Rs. 24,000
Direct Labour	30,000
Variable overheads	18,000
Fixed overheads	18,000
Total	<u>90,000</u>

The component 'X' however is available for purchase at the market at Rs. 8.00 each.

(iii) In the event of the company deciding to purchase the component 'X' from market, the company has two alternatives for the use of the capacity so released as under :

- (a) Rent out the released capacity at Re. 1/-per hour.
 (b) Manufacture component 'Y' which can be sold at Rs. 8'00 per unit. The cost data of this component for 10,000 units are :

Direct Materials	Rs. 30,000
Direct Labour	15,000
Factory variable overheads	9,000
Other variable overheads	21,000
Total	75,000

Required :

(i) Prepare a statement showing the profitability of the company as originally envisaged in the budget.

(ii) Evaluate the export order and state whether it is acceptable or not.

(iii) Make an appraisal of proposal to manufacture component 'X' and state whether the component 'X' should be manufactured in the factory or purchased from the market. Assume that no alternative use of spare capacity is available.

(iv) Evaluate the alternative use of the spare capacity and state whether to manufacture or buy the component 'X' and if your decision is to buy the component 'X' which of the two alternatives for the use of spare capacity will you prefer ?

(I.C.W.A. Final, December 1987)

Solution :

(i) Statement showing profitability of the company as originally envisaged.

Sales 1,20,000 × Rs. 100		Rs. 1,20,00,000
Less V. Cost :		
D. Material 1,20,000 × Rs. 21	Rs. 25,20,000	
D. Wages 1,20,000 × Rs. 20	24,00,000	
Component X's Variable cost		
@ Rs. 7'20 per unit	8,64,000	
Factory Overhead @ Rs. 12 per unit	14,40,000	
S. & D. Overhead @ Rs. 9 per unit	10,80,000	83,04,000
Contribution		36,96,000
Fixed Overhead :		
Factory	Rs. 14,40,000	
S & D	3,60,000	
Component 'X'	2,16,000*	
Adm. O.H.	4,80,000	24,96,000
Profit as per original budget		12,00,000

*Total cost of X component as given—Variable cost=Fixed Cost
 or $1,20,000 \times \text{Rs. } 9'00 - 1,20,000 \times 7'20 = \text{Rs. } 2,16,000$

(ii) Selling Price (Export Order)		Rs. 120'00
Less : Variable Cost :		
D. Material	Rs. 40'00	
D. Labour (8 × Rs. 5)	40 00	
S & D O.H.	10'00	
Factory O.H. (8 × Rs. 3)	24'00	114'00
	-----	-----
Contribution		6'00

Since the product earns a contribution of Rs. 6 per unit, it should be accepted because capacity is available for utilization as is clear from data given below :

Total hours to be used by Product A (1,20,000 × 4 hrs)	4,80,000
Total hours used by X—1,20,000 × 0.6 hr, i.e., 3 ÷ 5	72,000

Hours available at 92% capacity	5,52,000
---------------------------------	----------

∴ Hours at 100% = 6,00,000

Hours remaining to be utilized = 48,000

Hours required by Export order = 500 × 8 hrs = 4,000 only

∴ Contribution per unit of export order and availability of capacity confirm its acceptance.

(iii)	Cost of decision to Manufacture	Cost of decision to Buy
D. Material	Rs. 24,000	
D. Labour	30,000	
Variable O.H.	18,000	
	-----	-----
Incremental cost of Decision	72,000	80,000
	=====	=====

Since capacity, is existing, it is profitable to make the product. Fixed cost of product 'X' is irrelevant to decision, because this facility has to be provided for product A.

(iv) Hours spent on X = 1,20,000 × 0.6 hr (i.e. 3 ÷ 5)	72,000
Cost of making X = 1,20,000 × Rs. 7.20	Rs. 8,64,000
Cost to buy X = 1,20,000 × Rs. 8.00	9,60,000
Excess of cost of buying to that of making (Rs. 9,60,000—Rs. 8,64,000)	Rs. 96,000
Less : Rent Income 72,000 hrs × Re. 1	72,000

Effective cost for not manufacturing 'X'	24,000

Contribution per unit of Y = (Rs. 80,000—Rs. 75,000) ÷ 10,000 units
or Re. 0.5 per unit

Number of units of Y, that can be produced in 72,000 hours

Direct Labour cost per unit of Y = Rs. 15,000 ÷ 10,000 unit
= Rs. 1.50

Number of Hrs. required for one unit of $Y = \text{Rs. } 1.5 \div 5 = 0.3 \text{ hr}$

Number of units of Y in 72,000 hours $= 72,000 \div 0.3 = 2,40,000$.

\therefore Total contribution from $Y = 2,40,000 \times 0.5 = \text{Rs. } 1,20,000$

It is more than effective cost for not manufacturing ' X '.

Conclusion. Therefore, company should not manufacture component X which should be purchased from market and component ' Y ' should be produced.

Authors' Special Notes

(1) *Make or buy decision.* (i) Determine relevant cost of making; (ii) if existing capacity can be alternatively used, then opportunity cost consideration, (iii) total of (i) and (ii) should be matched with buying cost.

(2) *Accepting/Quoting for an order/Export order/specific decision like spending on advertisement*—In cost analysis, contribution approach should be used and in pricing analysis concentrate on recovery of incremental cost (Problems P 10-16, 10-19, 10-42, 10-52 (irrelevant cost is more)).

(3) Identify the alternatives under consideration and their relevant cost (Problems P 10-38, 10-50, 10-54, 10-62)

(4) In a situation of scarce resources or alternative uses, opportunity cost concept becomes relevant (Problems P 10-58, 10-60).

(5) In using differential cost concept, company should stop expenditure, when differential expenses are equal to differential gains (Problems P 10-34, 10-39, 10-45).

(6) Final level students should note that most of the problems in decision-making relate to treatment/computation of fixed O.H. in one form or other. Note the quoted language or main points in the problem referred to here. *Problem 10-14*—"50% of F.O.....5% of Sales"; *P 10-15* FO application rate... of 70% capacity utilization—" *P 10-12*—"He worked 50% of his capacity... Sales Rs. 2 (25% variable)"; *P 10-26*—Computation of FO of Rs. 70,000 is only point;

(7) Students of CA (Fin I) should particularly note that in their examination questions are frequently asked in one form or other expecting them to appraise (i) tax implication of decisions (ii) time cost of decision-DCF (Problems P 10-25, P 10-35,

(8) Correct interpretation of language is the crux of decision making. Concentrate to improve in a planned manner your sensitivity to language used in decision making by keeping a list on following pattern :

Problem 10-21—"The export order will fetch the company an export licence..... is Rs 60 per tonne" ; *P 10-22*—"The released machine will be used for producing Pomade ; *P 10-28*—"In this problem, two clues are given for finding out unit cost. Readers should test their knowledge *P 10-29*—"If additional production is required in any of these factories,

the labour cost will increase by 10% of the labour cost of such additional capacity due to overtime work"; P10-30—In this question net cost should be compared with the cost to be paid to M/s Helping Hands.

This Chapter is most important for C.A. (Final) and I.C.W.A. (Final) students. It has, therefore, become necessary to segregate the problems of this chapter according to above classifications :

CA (Final)

Evaluation of Alternative Proposals. (Problems 10-2, 10-48, 10-50, 10-51, 10-52, A 75)

Cost Indifference Point. (Problem 10-47)

Incremental Concept. (Problems, 10-7, 10-21, 10-27, 10-34, 10-41)

Modernisation or Investment Decisions : (Problems 10-23, 10-25)

Production Decisions (P 10-27, 10-36, A 110)

Accepting or Rejecting an order : (Problems 10-10, 10-12, 10-13, 10-15, A10)

Make or Buy (P A12, using cash flows A107)

Expand or Contract (Problem 10-14)

I.C.W.A. (Final)

Make or Buy (P 10-3, 10-4, 10-5, 10-6, A50, A95)

Accepting/Quoting for an Order or Contract. (Problems 10-8, 10-9, 10-17, 10-18, 10-19, 10-20 A 23, A 35, A 49)

Relevant Cost (Problems 10-38, 10-53, 10-54, A 35, A 49, A 50, A 56)

Cost Indifference Point A 121

Marketing Decisions. A 23, A 125.

Incremental Approach (Problems 10-16, 10-21, 10-31, 10-39, 10-42, A 19)

Evaluation of proposals. (Problems 10-35, 10-44, 10-49, 10-55, 10-56,

Value Added A 38, A 132 10-57, 10-59, A 101).

Understanding Peculiar Situation

(a) 10-28—Diversification (Clues given to find unit cost)

(b) 10-31; Determination of fixed cost

(c) 10-33 Shutdown point

(d) 10-26 Replacement of existing machinery

(e) 10-45—Optimum utilization of scarce resources

Special Key Factors Considerations. (Problems 10-22, 10-29)

Modernisation or Investment Decision P 10-23, A66, A 87, A 98, A 100

Only following problems are relevant to intermediate level students :—

Make or Buy— P10-1, A45, A163

Accepting Quoting for an order—P 10-8

Export Order—P 10-16, 10-19

Marketing Decisions— P10-42, A31, A147

Choice of Best Alternative—P10-52, A136

Please also refer to the Examples 11-1 to 11-22 of the book "Advanced Cost and Management Accounting—Text" by Saxena and Vashist.

Budgetary Control

[Flexible Budget 11-1—11-9, Functional Budget 11-10—11-24, Budgeted Income Statement 11-25—26, Responsibility Accounting 11-27—11-30, Miscellaneous 11-31—11-37.]

FLEXIBLE BUDGETS

Flexible Budget (Average cost and BE level)

Problem 11.1. Vivek Elementary School has a total of 150 students consisting of 5 sections with 30 students per section. The school plans for a picnic around the city during the week-end to places such as the zoo, the amusement park, the planetarium etc. A private transport operator has come forward to lease out the buses for taking the students. Each bus will have a maximum capacity of 50 (excluding 2 seats reserved for the teachers accompanying the students). The school will employ two teachers for each bus, paying them an allowance of Rs. 50 per teacher. It will also lease out the required number of buses. The following are the other cost estimates :

	<i>Cost per student</i>
Breakfast	Rs. 5
Lunch	10
Tea	3
Entrance fee at zoo	2
Rent Rs. 650 per bus.	
Special permit fee Rs. 50 per bus.	
Block Entrance fee at the planetarium Rs. 250.	
Prizes to students for games Rs. 250	

No costs are incurred in respect of the accompanying teachers (except the allowance of Rs. 50 per teacher).

You are required to prepare :

- (a) A flexible budget estimating the total cost for the levels of 30, 60, 90, 120 and 150 students. Each item of cost is to be indicated separately.
- (b) Compare the average cost per student at these levels.
- (c) What will be your conclusions regarding the break-even level of students if the school proposes to collect Rs. 45 per student ?
(C.A. Inter, Nov. 1988)

Solution**(a) Flexible Budget for different levels**

No. of Students	30	60	90	120	150
<i>Variable Costs</i>					
Breakfast	Rs. 150	Rs. 300	Rs. 450	Rs. 600	Rs. 750
Lunch	300	600	900	1,200	1,500
Tea	90	180	270	360	450
Entrance fee	60	120	180	240	300
Sub-total (A)	600	1,200	1,800	2,400	3,000
Variable cost/unit	20	20	20	20	20
<i>Semi-variable Costs</i>					
Bus Rent	650	1,300	1,300	1,950	1,950
Special permit fee	50	100	100	150	150
Allowance for teachers	100	200	200	300	300
Sub-total (B)	800	1,600	1,600	2,400	2,400
<i>Fixed cost</i>					
Block entrance fee	250	250	250	250	250
Prize to students	250	250	250	250	250
Sub total (C)	500	500	500	500	500
Total cost (A+B+C)	1,900	3,300	3,900	5,300	5,900
(b) Cost per student	63.33	55.00	43.33	44.17	39.33

(C) Break-even level

Collection per student	= Rs. 45
Less Variable Cost	20
Contribution	25

Since semi-fixed costs relate to a block of 50 students, the fixed and semi-variable cost for three levels will be :

Level of student	up to 50	51- 100	101- 150
Fixed + Semi-variable costs	Rs. 1,300	Rs. 2,100	Rs. 2,900
Contribution per unit	25	25	25
B.E. level of students	52	84	116

Flexible Budget and Marketing Cost Allowance

Problem 11'2. The marketing director of W Limited is dissatisfied with the variances reported to him on the basis of actual costs being compared with a fixed budget for the costs attributed to the marketing function. He seeks your help and asks you to prepare for him a flexible budget for the calendar year 1987, based on the following information which is stated for an estimated sales level of Rs. 10 million unless stated otherwise.

	Rs. '000
Fixed costs :	
Salaries—Sales representatives	200
— Sales office	60
Salary-related costs	32
Rent	100
Depreciation of furniture	5
Depreciation of cars	67
Insurance	20
Advertising	250

Variable costs :

Sales representatives' commission	64
Salary related costs—12½% of commission	8
Sales representatives' ordinary expenses	25
Bad debts	100
Stationery and postage	50
Agency fees	80

Semi-variable costs :

Telephone . rentals Rs. 2,000, metered calls Rs. 14,000

Sales representatives' car expenses excluding depreciation : fixed Rs. 7,000 and variable Rs. 48,000

Sales promotion : the budget figures are to be based on the costs given below which relate to the years 1982 to 1985 and the estimates for 1986.

Year	Costs (Rs. '000)	Sales (Rs. million)
1982	384	4.2
1983	402	5.1
1984	368	3.4
1985	450	7.5
1986 Estimate	478	Estimate 8.9

Ignore Inflation

You are required to :

(a) prepare a flexible budget for sales levels of Rs. 9 million, Rs. 10 million, and Rs. 11.5 million ;

(b) calculate the total marketing cost allowance, assuming sales of Rs. 10.75 million.

[C.I.M.A. London, March 1986]

Solution.

(Rs. '000)

Level of sales	Flexible Budget		
	9,000	10,000	11,500
Variable costs :			
Sales representatives' commission	57.6	64	73.6
Sales-related cost (12½% of commission)	7.2	8	9.2
Sales representatives' ordinary expenses	22.5	25	28.75
Bad Debts	90.0	100	115.0
Stationery and Postage	45.0	50	57.5
Agency fees	72.0	80	92.0
Telephones	12.6	14	16.1
Representatives' car expenses	43.2	48	55.2
Sales promotion	180.0	200	230.0
Total variable costs	530.1	589	677.35
Fixed costs :			
Sales Representatives' salary	200	200	200
Sales office salaries	60	60	60
Salary, related cost	32	32	32
Rent	100	100	100
Depreciation of furniture	5	5	5
Depreciation of cars	67	67	67
Insurance	20	20	20
Advertising	250	250	250
Telephone	2	2	2
Sales Rep. car exp.	7	7	7
Sales promotion	300	300	300
	1043	1043	1043
Total cost	*1573.1	1632	1720.35

Variable cost per unit = change in total cost ÷ change in activities.

$$= \frac{\text{Rs. } 402000 - \text{Rs. } 384000}{5100000 - 4200000} = \frac{\text{Rs. } 18000}{900000} = \text{Rs. } 0.02$$

∴ V. cost of 4.2 million = 4200000 × 0.02 = Rs. 84000

*Analysis is being attempted to determine the cost attributed to marketing function.

∴ Fixed cost = Rs. 384000 — Rs. 84000 = Rs. 300000

(b) Marketing cost for sales of Rs. 10.75 million

Variable cost = $\frac{10.75}{10.00} \times \text{Rs. } 589000$	= Rs. 633175
Fixed costs	= 1043000
Total marketing costs	1676175

Flexible budget for overheads

Problem 11.3. Draw up a flexible budget for overhead expenses on the basis of the following data and determine the overhead rates at 70%, 80% and 90% plant capacity levels.

At 80% Capacity

Variable Overheads :

Indirect labour	Rs. 12,000
Indirect material	4,000

Semi-variable Overheads :

Power (30% fixed, 70% variable)	20,000
Repairs and maintenance (60% fixed, 40% variable)	2,000

Fixed Overheads :

Depreciation	11,000
Insurance	3,000
Others	10,000
Total overheads	62,000

Estimated direct labour hours

1,24,000 Hrs.
(I.C.W.A. Inter, June 1989)

Suggested Approach :

Before solving the question, it is necessary to work out variable cost per 10% of the activity level as it is required to work out flexible budget at 70%, 80% and 90% capacity level.

Variable overheads per 10% capacity level

- (1) Indirect labour = Rs. 12,000 $\times \frac{10}{80}$ or, Rs. 1,500
- (2) Indirect material = Rs. 4,000 $\times \frac{10}{80}$ or, Rs. 500

Segregation of Variable and Fixed element of Semi-variable Overheads

- (1) Power (variable 70% ; fixed 30%)

- (a) Variable overheads $= 20,000 \times 70\%$ or, Rs. 14,000
 Variable overhead per 10% capacity level

$$= \text{Rs. } 14,000 \times \frac{10}{80} \text{ or, Rs. } 1,750$$

- (b) Fixed overhead $= 20,000 \times 30\%$ or, Rs. 6,000

- (2) Repairs and Maintenance (variable 40%, fixed 60%)

- (a) Variable overheads $= 2,000 \times 40\%$ or, Rs. 800

Variable overhead per 10% capacity level $= \text{Rs. } 800 \times \frac{10}{80}$ or, Rs. 100

- (b) Fixed cost $= 2,000 \times 60\%$ or, Rs. 1,200

- (3) Estimated direct labour hours at 80% capacity $= 1,24,000$ hours

Variable with respect to 10% variation $= 1,24,000 \times \frac{10}{80}$ or, 15,500 hrs.

Solution : **Flexible Budget for Overhead**
for the period ending.....

Details	Variability for every 10% variation in capacity level	Capacity levels		
		70%	80%	90%
1. Variable Overhead :	Rs.	Rs.	Rs.	Rs.
(a) Indirect labour	1,500	10,500	12,000	13,500
(b) Indirect material	500	3,500	4,000	4,500
2. Variable portion of Semi-variable overhead :				
(a) Power	1,750	12,250	14,000*	15,750
(b) Repairs and maintenance	100	700	800*	900
(A) Total variable		26,950	30,800	34,650
3. Fixed portion of Semi-variable overhead :				
(a) Power		6,000	6,000*	6,000
(b) Repairs and maintenance		1,200	1,200*	1,200
4. Fixed overhead :				
(a) Depreciation		11,000	11,000	11,000
(b) Insurance		3,000	3,000	3,000
(c) Others		10,000	10,000	10,000
(B) Total fixed		31,200	31,200	31,200

5. Total overheads (A+B)		58,150	62,000	65,850
6. Estimated direct labour hrs.	15,500	1,08,500	1,24,000	1,39,500
7. Overhead recovery rate per direct labour hour ($5 \div 6$)		Re. 0.5359	Re. 0.5000	Re. 0.4720

* Please see suggested approach for segregation of semi-variable overheads into variable and fixed elements.

Flexible Budget for different levels.

Problem 11.4. A factory is currently working at 50 per cent capacity and produces 10,000 units. Estimate the profits of the Company when it works to 60 per cent and 80 per cent capacity assuming that the company can sell whatever it produces.

At 60 per cent working, raw material cost increases by 2 per cent and selling price falls by 2 per cent. At 80 per cent, raw material cost increases by 5 per cent and selling price falls by 5 per cent.

At 50 per cent working, the product costs Rs. 180 per unit and is sold at Rs. 200 per unit.

The unit cost of Rs. 180 is made up as follows :

	Rs.
Material	100
Labour	30
Factory Overhead	30 (40% fixed)
Administration Overhead	20 (50% fixed)

What comments can you offer ?

[(ICWA Inter, June 1984, C.A. Inter, Nov. 1984)]

Solution.

Statement showing profit at different Capacity level

Units	Capacity levels		
	50%	60%	80%
	10000	12000	16000
	Rs.	Rs.	Rs.
Selling price per unit (as per information given)	200	196	190

Material (as per information given)	100	102	105
Labour	30	30	30
Factory overhead	18	18	18
Administration overhead	10	10	10
Total Marginal cost per unit	158	160	163
Contribution per unit	42	36	27
Total contribution	4,20,000	4,32,000	4,32,000
Less : Fixed cost	2,20,000	2,20,000	2,20,000
Profit	2,00,000	2,12,000	2,12,000
P/V ratio	21%	18.37%	14.21%
Incremental profit (by comparing profit at preceding level)	—	12,000	—

Comments

P/V ratio is highest at 50% capacity level. It is beneficial for company to switch over to 60% because at this level profit will be maximum, because at this level impact by increase in sales revenue due to increase in sales volume *and incidence of fixed cost* is more than the increase in variable cost. At 80% capacity level increase in variable cost is more than the increase in sales revenue due to sales volume *and incidence of fixed cost*.

Problem 11.5. Action Plan Manufacturers normally produce 8000 units of their product in a month in their machine shop. For the month of January, they had planned for a production of 10,000 units. Owing to sudden cancellation of contract in the middle of January, they could only produce 6000 units in January.

Indirect manufacturing costs are carefully planned and monitored in the machine shop and the Foreman of the shop is paid a 10% of the savings as bonus when in any month the indirect manufacturing cost incurred is less than the budgeted provision.

The Foreman has put in a claim that he should be paid a bonus of Rs. 88'50 for the month of January. The works manager wonders how any one can claim a bonus when the company has lost a sizable contract. The relevant figures are as under :

<i>Indirect manufacturing costs</i>	<i>Expenses for a normal month</i>	<i>Planned for January</i>	<i>Actuals in January</i>
Salary of Foreman	Rs. 1,000	Rs. 1,000	Rs. 1,000
Indirect labour	720	900	600
Indirect material	800	1,000	700
Repairs and maintenance	600	650	600
Power	800	875	740
Tools consumed	320	400	300
Rates and taxes	150	150	150
Depreciation	800	800	800
Insurance	100	100	100
	<u>5,290</u>	<u>5,875</u>	<u>4,990</u>

Do you agree with the Works Manager ? Is the Foreman entitled to any bonus for the performance in January ? Substantiate your answers with facts and figures. (C.A. Inter, May 1986)

Solution.

Refer to page 11.10 for flexible budget.

Conclusion. The analysis in flexible budget on next page makes it very clear that the expenditure of M/s. "Action Plan Manufacturers" has increased from Rs. 4,705 to Rs. 4,990. under these circumstances, the foreman of the company is not entitled for any performance bonus.

Marking Notes

1. Indirect labour for 8000 units=Rs. 720

" " " 10000 units= $\frac{720}{8000} \times 10000$ or Rs. 900

∴ Indirect labour which is variable, per unit=Re. 0.09

∴ Indirect labour for 6000 units=6000×0.09 or Rs. 540

2. Indirect Material

Indirect material for 8000 units=Rs. 800

Indirect material for 10000 units= $\frac{800}{8000} \times 10000$ or Rs. 1000

Working notes Contd. to page 11.10.

Flexible budget of "Action Plan Manufacturers"
(For the month of January)

<i>Indirect manufacturing costs</i>	<i>Nature of cost</i> (1)	<i>Expenses for a normal month</i> (Rs.) (2)	<i>Planned expenses for January</i> (Rs.) (3)	<i>Expenses as per flexible budget of January</i> (Rs.) (4)	<i>Actual expenses for the month of January</i> (Rs.) (5)	<i>Difference Increase (Decrease)</i> (5), (4), =(6)
Salary of Foreman	Fixed	1000	1000	1000	1000	Nil
Indirect labour (Note 1)	Variable	720	900	540	600	60
Indirect material to Note 2)	Variable	800	1000	600	700	100
Repair and maintenance (Note 3)	Semi-variable	600	650	550	600	50
Power (Note 4)	Semi-variable	800	875	725	740	15
Tools consumed	Variable	320	400	240	300	60
Rates and taxes	Fixed	150	150	150	150	Nil
Depreciation	Fixed	800	800	800	800	Nil
Insurance	Fixed	100	100	100	100	Nil
		<u>5,290</u>	<u>5,875</u>	<u>4,705</u>	<u>4,990</u>	<u>285</u>

∴ it is variable and indirect material for 6000 units

$$= \frac{800}{8000} \times 6000 \text{ or Rs. } 600$$

3. Repair and Maintenance

Repair and maintenance of 8000 units = Rs. 600

“ “ “ of 10000 units = $\frac{600}{8000} \times 10000$ or Rs. 750

But as per budget ; Repair and Maintenance for 10,000 is Rs. 650

Repair and Maintenance is semi-variable

∴ Variable R and M per unit = $\frac{\text{Change in Exp. level}}{\text{change in output}}$

$$= \text{Rs. } \frac{50}{2000} \text{ or Rs. } 0.025$$

Variable element of R and M at levels of 8000 units = 8000×0.025
 or Rs. 200

∴ Fixed element of R and M at level of 8000 units

$$= \text{Rs. } 600 - \text{Rs. } 200 = \text{Rs. } 400$$

R and M cost at level of 6000 units

$$\text{Rs. } = 400 + (6000 \times \text{Rs. } 0.025) \text{ or Rs. } 550$$

4. Power

Power for 8000 units = Rs. 800

Power for 10000 units = $\text{Rs. } \frac{800}{8000} \times 10000$ or Rs. 1000

But, it is given that power for 10000 units is Rs. 875.

∴ Power is semi-variable overhead.

∴ Variable power per unit = $\frac{\text{change in Exp. level}}{\text{change in output}}$

$$= \frac{75}{2000} = \text{Rs. } 0.0375$$

Variable element of power at the level of 8000 units

$$= 8000 \times \text{Rs. } 0.0375 \text{ or Rs. } 300$$

Fixed element of power at level of 8000 units = $\text{Rs. } 800 - 300$ or
 Rs. 500.

Power at the level of 6000 units = $500 + (6000 \times \text{Rs. } 0.0375) = \text{Rs. } 725.$

5. Tools Consumed

Tools consumed at the level of 8000 units = 320

Tools consumed at the level of 10,000 units

$$= \frac{320}{8000} \times 10000 \text{ or Rs. } 400.$$

∴ Tools consumed is variable overhead.

∴ Tool consumed at the level of 6000 units

$$= \frac{320}{8000} \times 6000 \text{ or Rs. } 240.$$

Unit cost at different capacity levels

Problem 11.6. The cost of an article at a capacity level of 10,000 units is given under *A* below. For a variation in capacity above or below this level, the individual expenses vary as indicated in *B* below :

	<i>A</i>	<i>B</i>
Material cost	Rs. 50,000	100% varying
Labour cost	30,000	100% "
Power	3,000	80% "
Repairs and Maintenance	3,500	80% "
Stores	2,000	100% "
Inspection	800	25% "
Depreciation	10,000	100% "
Administration overhead	3,600	25% "
Selling overhead	4,500	50% "
Total	1,07,400	
Cost per unit	10.74	

Find out the unit cost of the product under each individual expenses at production level of 8,000 units and 12,000 units.

[ICWA. Inter, Dec. 1982]

Solution. Flexible Budget at Different Capacity Levels.

<i>Production (units)</i>	<i>10,000</i>	<i>8,000</i>	<i>12,000</i>
1. Variable cost :	Rs.	Rs.	Rs.
Material (100% variable)	50,000	40,000	60,000
Labour (,,)	30,000	24,000	36,000
Power (80% variable)	2,400	1,920	2,880
Repairs "	2,800	2,240	3,360
Stores (100% variable)	2,000	1,600	2,400
Inspection (25% variable)	200	160	240
Depreciation (100% variable)	10,000	8,000	12,000
Admn. overhead (25% variable)	900	720	1,080
Selling overhead (50% variable)	2,250	1,800	2,700
Total variable cost	1,00,550	80,440	1,20,660
2. Fixed cost :			
Power (20% fixed)	600	600	600
Repairs (20% fixed)	700	700	700
Inspection (75% fixed)	600	600	600
Admn. overhead (75% fixed)	2,700	2,700	2,700
Selling overhead (50% fixed)	2,250	2,250	2,250
Total fixed cost	6,850	6,850	6,850
Total cost (1+2)	1,07,400	87,290	1,27,510
Cost per unit	10.74	10.91	10.63

Flexible budget preparation after expansion programme

Problem 11.7. A manufacturing company having a capacity of 6 lakh units has prepared the following cost sheet :

	Per unit
Direct Materials	Rs. 2.50
Direct wages	1.00
Factory overheads	2.00 (50% fixed)
Selling and Adm. Overheads	1.50 (one-third variable)
Selling Price	9.00

During the year 1981, the sales volume achieved by the company was 5 lakh units. The company has launched an expansion programme, the details of which are as under :

- (a) The capacity will be increased to 10 lakhs units.
- (b) The additional fixed overheads will amount to Rs. 4 lakhs up to 8 lakh units and will increase by Rs. 2 lakhs more beyond 8 lakh units.
- (c) The cost of investment on expansion is Rs. 8 lakhs which is proposed to be financed through bank borrowings carrying interest at 15% per annum.
- (d) The average depreciation rate on the new investment is 10% based on straight line method.

Assume that the company's profits are taxed at the rate of 50%.

After the expansion is put through, the company has two alternatives for operating the expanded plant as under :

- (i) Sales can be increased up to 8 lakh units by spending Rs. 1,00,000 on special advertisement campaign to explore new market or
- (ii) Sales can be increased to 10 lakh units subject to the following :
 - (a) By an overall price reduction of Re. 1 per unit on all the units sold.
 - (b) By increasing the variable selling and administration expenses by 5%.
 - (c) The direct material costs would go down by 1% due to discounts on bulk buying.

Required :

- A. Construct a flexible budget at the level of 5 lakhs, 8 lakhs and 10 lakh units of production and advise which level of output should be chosen for operation.
- B. Calculate the break-even point both before and after expansion.

- C. Find the payback period for the investment made on expansion at the level of activity chosen by you for operation.

[I.C.W.A. Final, June 1984]

Solution.

A. Flexible Budget :		Rs. in lakhs		
Output levels (units)	5 lakhs	8 lakhs	10 lakhs	
Sales	45.00	72.00	80.00	
Direct Materials (@ Rs. 2.50 per unit, but at a level of 10 lakhs discount of 1% is to be allowed)	12.50	20.00	24.75	
Direct wages	5.00	8.00	10.00	
Factory overhead	5.00	8.00	10.00	
Selling and Admn. overhead (at level of 10 lakhs variable S. and Adm. increase by 5%)	2.50	4.00	5.25	
Total variable cost	25.00	40.00	50.00	
Contribution	20.00	32.00	30.00	
Fixed Expenses :				
Fixed Factory Overhead	6.00	6.00	6.00	
Selling and Adm.	6.00	6.00	6.00	
Increase due to expansion	—	4.00	6.00	
Interest @ 15% on 8 lakhs	—	1.20	1.20	
Depreciation @ 10% on 8 lakhs	—	0.80	0.80	
Special Advertisement	—	1.00	—	
Total Fixed Expenditure	12.00	19.00	20.00	
Profit	8.00	13.00	10.00	

Therefore, activity to be chosen is 8 lakhs

B. Break-Even point

Rs. in lakhs	27.00	42.75	53.33
Working	$\left\{ S \times \frac{20}{45} = 12 \right\}$	$\left\{ S \times \frac{32}{72} = 19 \right\}$	$\left\{ S \times \frac{30}{80} = 20 \right\}$
No. of units	3.0 lakhs	4.75 lakhs	6.67 lakhs

C. Payback period for investment made on expansion at level of activity chosen during operation.

Activity chosen is 8 lakhs

Profit at 8 lakhs	=13.00 lakhs
„ „ 5 „	=8.00 „
Differential profit due to expansion	5.00 „
Tax 50%	2.50 „
Profit available after tax	2.50 „
Cost of expansion	8.00 „
∴ Payback period is $(8.00 \div 2.50)$	3.2 years.

Contribution and profit forecast at 50% activity level

Problem 11.8. (a) Exe p.l.c. manufactures one standard product and in common with other companies in the industry is suffering from the current depression in the market. Currently it is operating at a normal level of activity of 70% which represents an output of 6,300 units, but the sales director believes that a realistic forecast for the next budget period would be a level of activity of 50%.

	Level of activity		
	60%	70%	80%
Direct materials	Rs. 37,800	Rs. 44,100	Rs. 50,400
Direct wages	16,200	18,900	21,600
Production overhead	37,600	41,200	44,800
Administration overhead	31,500	31,500	31,500
Selling and distribution overhead	42,300	44,100	45,900
Total cost	165,400	179,800	194,200

Profit is 20% of selling price.

You are required, from the data given in the current flexible budget above, to prepare a budget based on a level of activity of 50%, which should show clearly the contribution which could be expected.

(b) Discuss briefly **three** problems which may arise from such a change in level of activity. (ICMA, London, May 1984 -Adapted)

Solution. Workings for cost at different activity levels

<i>Units</i>	<i>Nature</i>	<i>60% 5400 Rs.</i>	<i>70% 6300 Rs.</i>	<i>80% 7200 Rs.</i>	<i>50% 4500 Rs.</i>
Direct material @ @ Rs. 7 per unit	V.	37,800	44,100	50,400	31,500
Direct wages @ Rs. 3 per unit	V.	16,200	18,900	21,600	13,500
Production overhead variable @ Rs. 4 per unit	S.V.	21,600	25,200	28,800	18,000
Fixed		16,000	16,000	16,000	16,000
Adm. overhead Sell- ing and Distribution	Fixed	31,500	31,500	31,500	31,500
Variable @ Rs. 2 per unit		10,800	12,600	14,400	9,000
Fixed		31,500	31,500	31,500	31,500
Profit 20% on sales or 25% on cost					1,51,000 37,750
					1,88,750

Budget for 50% activity level i.e., 4500 Units

	<i>Rs.</i>	<i>Rs.</i>
Sales		188750
Less : Variable Cost :		
Material	31,500	
Labour	13,500	
P. Overhead	18,000	
Selling and Distribution	9,000	72,000
Contribution		1,16,750
Less : Fixed cost :		
Production overhead	16,000	
Administration	31,500	
Selling and distribution	31,500	79,000
		37,750

Notes**(x) Direct Material :**

	Rs. 44,100 37,800	Rs. 50,400 44,100
Difference in cost	6,300	6,300
Difference in units	900	900
Variable cost per unit	7	7

Therefore material is all variable

Direct wages per unit should be calculated similarly

(v) Production overhead

	Rs. 41,200 37,600	Rs. 44,800 41,200
Difference in cost	3,600	3,600
Difference in units	900	900
Variable cost per unit	4	4

∴ For 5400 units, variable cost will be Rs. 21,600 i.e. $5,400 \times 4$ and fixed cost will be Rs. 16,000, i.e., $37,600 - 21,600$

(b) There is depression and following representative problems are likely to be faced.

(i) Under-absorption of fixed production overhead.

(ii) Administrative staff will become redundant. This would almost certainly be criticised by trade union.

(iii) All this will lead to cash flow problems which may necessitate taking bank loan to come over the recession.

Production to be achieved by earning same profit as in previous year

*Problem 119 VINAL Ltd. a company engaged in the manufacture of electrical appliances has set the following budget for 1981 :

	<i>Immersion Heaters</i>	<i>Table Lamps</i>	<i>Bread Toasters</i>	<i>Room Heaters</i>
Production (Units)	40,000	10,000	50,000	30,000
Selling Price per Unit	Rs. 30'00	Rs. 50'00	Rs. 60'00	Rs. 80'00
Cost per Unit :				
Direct Materials	6'00	13'50	10'50	24'00
Direct Labour	7'50	10'00	18'00	24'00
Variable Overheads	4'50	10'00	12'00	13'00
Fixed Overheads	7'50	10'00	18'00	24'00
Profit/Loss	4'50	6'50	1'50	(—) 5'00

When the budget was placed before the Budget Committee, the Marketing Manager put up a proposal to increase the sales by 20,000 additional units for which capacity existed. The additional 20,000 units could be one product or any combination of products. The proposal was accepted by the committee.

The committee also decided that the production capacity for the next year, namely 19X2 could be set in such a way that there would be a further increase in the output by 50,000 units over and above the increase of 20,000 units envisaged for 19X1. The additional production of 50,000 units would be of table lamps only for which a new plant would be acquired. The additional fixed expenses of the new plant were estimated at Rs. 70,000 per annum. During 19X2, raw material and labour costs were expected to increase by 10% but the other costs and selling expenses would remain the same.

Required : (i) Set a budget for 19X1 in such a way that the additional capacity of 20,000 units is utilised to maximise the profits.

(ii) Set a budget for 19X2.

(iii) Assuming that the increased output may not fully materialise, calculate the number of units of table lamps required to be sold in 19X2 at the given price in order to ensure that profitability at least at 19X1 level is maintained.

(I.C.W.A. Final, Dec., 1983)

Solution. (i) Statement showing the budget for 19X1 (including additional capacity of 20,000 units)

Per unit	Immersion Heaters	Table Lamps	Bread Toasters	Room Heaters	Total
1. Selling price	Rs. 30.00	Rs. 50.00	Rs. 60.00	Rs. 30.00	
2. Variable Costs					
Direct material	6.00	13.50	10.50	24.00	
Direct labour	7.50	10.00	18.00	24.00	
Variable overheads	4.50	10.00	12.00	13.00	
Total of 2	18.00	33.50	40.50	61.00	
3. Contribution (1-2)	12.00	16.50	19.50	19.00	
4. Production (including addl. production of 20,000 of Bread-toasters)	40,000	10,000	70,000	30,000	
5. Total contribution (3×4)	4,80,000	1,65,000	13,65,000	5,70,000	25,80,000
6. Total Fixed overheads					20,20,000*
7. Net profit (5-6)					5,60,000

**Fixed overheads*

	<i>Original production</i>	<i>F.O. Rate</i>	<i>Total overhead</i>
Immersion Heaters	40,000	Rs. 7.50	Rs. 3,00,000
Table Lamps	10,000	10 00	1,00,000
Bread Toasters	50,000	18.00	9,00,000
Room Heaters	30,000	24.00	7,20,000
Total fixed overheads			<u>20,20,000</u> =====

(ii) Statement showing the budget for 19X2

<i>Per unit</i>	<i>Immersion Heaters</i>	<i>Table Lamps</i>	<i>Bread Toasters</i>	<i>Room Heaters</i>	<i>Total</i>
1. Selling price	Rs. 30.00	Rs. 50.00	Rs. 60.00	Rs. 80.00	
2. <i>Variable costs</i>					
Direct materials (10% increase)	6.60	14.85	11.55	26.40	
Direct labour (10% increase)	8.25	11.00	19.80	26.40	
Variable overheads (no change)	4.50	10.00	12.00	13.00	
Total of (2)	<u>19.35</u>	<u>35.85</u>	<u>43.35</u>	<u>65.80</u>	
3. Contribution	10.65	14.15	16.65	14.20	
4. Total production [as in (i) above plus 50,000 table lamps]	40,000	60,000	70,000	30,000	
5. Total contribution (3 × 4)	4,26,000	849,000	11,65,500	4,26,000	28,66,500
6. Fixed overhead (including addl. F.O. Rs. 70,000)					<u>20,90,000</u>
7 Profit					<u>7,76,500</u>

(iii)

	<i>Immersion Heaters</i>	<i>Table Lamps</i>	<i>Bread Toasters</i>	<i>Room Heaters</i>	<i>Total</i>
1. Production (without addl. 50,000 units of Table lamps)	40,000	10,000	70,000	30,000	
2. Contribution per unit Rs. (as per 19X2 budget)	10.65	14.15	16.65	14.20	

3. Total contribution	
(Rs.)	4,26,000 1,41,500 11,65,500 4,26,000 21,59,000
4. Less Fixed cost (as per 19X1 budget)	20,20,000
5. Profit for 19X2 (before increase in output)	1,39,000
6. Profit for 19X1	5,60,000
7. Additional profit required (6—5)	4,21,000
8. Additional fixed cost for 19X2	70,000
9. Total profit required to earn the same level of profit as for 19X1	4,91,000
10. Contribution per unit of table lamps	Rs. 14.15
11. Minimum table lamps to be produced (9 ÷ 10)	Units 34,700

FUNCTIONAL BUDGETS

Preparation of Production Budgets

Problem 11.10. ABC Ltd. makes two types of polish—one for floors and one for cars. It sells both types to industrial users only, in one litre containers. The specifications for the two products per batch of 100 litres are :

Materials	Floor Polish	Car Polish
Delta	120 litres	100 litres
Gamma	20 kg	10 kg
Containers—Cost per 100	Rs. 100	Rs. 100
Direct Labour		
Manufacturing	12 man-hours	16 man-hours
Primary Packing	5 man-hours	5 man-hours

During the six months to end of 30th September, the company expects to sell 15,000 litres of floor polish at Rs. 9 per litre and 25,000 litres of car polish at Rs. 7 per litre. Materials are expected to cost Re. 1 a litre for Delta and Rs. 8 a kg. for Gamma.

Manufacturing wages in the industry look like being stable at Rs. 6 per hour and packing wages at Rs. 4 per hour throughout the period.

Flexible overhead expense budgets are operated for manufacturing and packing departments based on the number of man-hours worked. These budgets for six months to end of September are :

Manufacturing Dept.			Primary Packing Dept.		
5,000	manhours	Rs. 40,000	1,700	manhours	Rs. 26,000
6,000	"	50,000	1,900	"	28,000
7,000	"	60,000	2,100	"	30,000
8,000	"	80,000	2,300	"	32,000

General administration overheads are budgeted at Rs. 37,000. At the beginning of the period 1st April, packed stocks will be :

Floor Polish	2,000 litres
Car Polish	3,000 litres

By end of the period 30th September, it is desired to maintain the packed stocks of the two products at 3000 litres and 4000 litres respectively. The following are required :

1. A statement of the standard prime cost per 100 litres of each product.
2. A sales and production budget (in quantities) for the six months to 30th September.
3. A profit forecast for the period. Show separate gross profits for the two products but do not attempt to allocate overheads between them. No overheads are included in stock valuations.

(I.C.WA. Inter, June 1987)

Solution.

1. Statement showing standard prime cost of 100 litres of each product

	Floor Polish	Car Polish
<i>Materials :</i>		
Delta @ Re. 1/litre	Rs. 120	Rs. 100
Gamma @ Rs. 8/kg	160	80
	<hr/>	<hr/>
Containers	280	180
	100	100
<i>Direct Labour :</i>		
Manufacturing @ Rs. 6/hour	72	96
Primary packing @ Rs. 4/hour	20	20
	<hr/>	<hr/>
	92	116
	<hr/>	<hr/>
Standard Prime cost	472	396
	<hr/>	<hr/>

2. Sales and production Budget (in litres) for the six months to 30th September

	Floor Polish	Car Polish
Sales (litres)	15,000	25,000
Add Closing stock	3,000	4,000
	<hr/>	<hr/>
Total	18,000	29,000
Less Opening stock	2,000	3,000
	<hr/>	<hr/>
Production	16,000	26,000
	<hr/>	<hr/>

3. Statement showing profit forecast for the period

	<i>Floor Polish</i>	<i>Car Polish</i>	<i>Total</i>
Quantity produced	16,000 lts.	26,000 lts.	
Quantity sold	15,000 lts.	25,000 lts.	
	Rs.	Rs.	Rs.
Sales value	1,35,000	1,75,000	3,10,000
Less Prime cost [Refer to (a)]	70,800	99,000	1,69,800
Gross margin	64,200	76,000	1,40,200
Less Overheads :			
Manufacturing	Rs. 50,800 (b)		
Packing	30,000 (c)		
Administration	37,000		1,17,800
Net profit for the period			22,400

Working Notes :(a) Floor Polish $15,000 \times \text{Rs. } 4.72 = \text{Rs. } 70,800$ Car polish $25,000 \times \text{Rs. } 3.96 = \text{Rs. } 99,000$ (b) *Overheads for manufacturing**Man hours required :*Floor polish $= (12 \text{ hrs.} \div 100 \text{ litres}) \times 16,000 = 1920 \text{ hrs}$ Car polish $(16 \text{ hrs} \div 100 \text{ litres}) \times 26,000 = 4160 \text{ hrs}$ 6080 hrs

Overheads for 6,000 hrs (given) = Rs. 50,000

Overhead for next 80 hrs

 $[(\text{Rs. } 60,000 - 50,000) \div (7,000 - 6,000)] \times 80 = 800$ Overheads of Manufacturing Deptt. 50,800(c) *Overheads for Primary Packing**Man hours required*Floor Polish $(5 \text{ hrs} \div 100 \text{ litres}) \times 16,000 = 800 \text{ hrs}$ Car Polish $(5 \text{ hrs} \div 100 \text{ litres}) \times 26,000 = 1300 \text{ ,,}$ 2,100Overheads for 2,100 hrs (Packing) 30,000**Note.** As given in the question, no overheads are included in stock valuation.

Problem 11-11 (Production Overhead Budget) At 100% capacity (1,00,000 hours), the monthly production overhead budget for a factory was as follows :

	<i>Rs.</i>	<i>Category</i>
Salaries	40,000	<i>C</i>
Indirect wages	8,000	<i>B</i>
Repairs and maintenance	5,000	<i>B</i>
Consumable Stores	4,000	<i>A</i>
Miscellaneous	5,000	<i>B</i>
Spoilage	2,000	<i>A</i>
Fuel and Power	15,000	<i>A</i>
	<u>79,000</u>	

The behaviour of various categories of expenses was as follows :

<i>Activity as a % of capacity</i>	<i>Multiplier A</i>	<i>Applicable to B</i>	<i>Budget C</i>
80	0.85	1.00	1.00
90	0.93	1.00	1.00
100	1.00	1.00	1.00
110	1.06	1.00	1.00
120	1.12	1.00	1.00
130	1.18	1.10	1.00
140	1.23	1.10	1.00
150	1.28	1.10	1.20

There were three products and in a month, the total production was expected to be :

<i>X</i>	10,000 units
<i>Y</i>	15,000 units
<i>Z</i>	5,000 units

The standard hours per unit of the three products were agreed to be 5 for *X*, 4 for *Y* and 6 for *Z*. Prepare the Production Overhead Budget for the concerned month. (I.C.W.A. Final, December 1987)

Solution. Production in terms of hours for the month

<i>Product</i>	<i>Units Produced</i>	<i>Std. hrs. per unit</i>	<i>Std. hrs. produced</i>
<i>X</i>	10,000	5	50,000
<i>Y</i>	15,000	4	60,000
<i>Z</i>	5000	6	30,000
			<u>1,40,000</u>

∴ Level of production = 140%

Production Overhead Budget for the month

<i>Item</i>	<i>Budget at Standard</i>	<i>Category</i>	<i>Multiplier at 140 %</i>	<i>Amount</i>
Salaries	Rs. 40,000	C	1'00	Rs. 40,000
Indirect Wages	8,000	B	1'10	8,800
Repairs & Maintenance	5,000	B	1'10	5,500
Consumable stores	4,000	A	1'23	4,920
Miscellaneous	5,000	B	1'10	5,500
Spillage	2,000	A	1'23	2,460
Fuel and Power	15,000	A	1'23	18,450
	<u>79,000</u>			<u>85,630</u>

Preparation of Sales, Purchases and Production Budgets

Problem 11'12. Soloproducts Ltd. manufactures and sells a single product and has estimated a sales revenue of Rs. 126 lakhs this year based on a 20% profit on selling price. Each unit of the product requires 3 lbs of material P and 1½ lbs of material Q for manufacture as well as a processing time of 7 hours in the Machine Shop and 2½ hours in the Assembly Section. Overheads are absorbed at a blanket rate of 33½% on Direct Labour. The factory works 5 days of 8 hours a week in a normal 52 weeks a year. On an average statutory holidays, leave and absenteeism & idle time amount to 96 hours, 80 hours and 64 hours respectively, in a year.

The other details are as under :

Purchase Price	Material P	Rs. 6 per lb
	Material Q	Rs. 4 per lb

Comprehensive Labour Rate	Machine Shop	Rs. 4 per hour	
	Assembly	Rs. 3.20 per hour	
No. of Employees	Machine Shop	600	
	Assembly	180	
	Finished Goods	Material P	Material Q
Opening Stock	20,000 units	54,000 lbs	33,000 lbs
Closing Stock (Estimated)	25,000 units	30,000 lbs	66,000 lbs

You are required to calculate :

- The number of units of the product proposed to be sold.
- Purchases to be made of Materials P and Q during the year in Rupees.
- Capacity utilisation of Machine Shop and Assembly Section, along with your comments.

[C.A. Inter, Nov. 1985]

Solution.

Working Notes

- Statement showing selling price per unit of product

Material P 3 lbs × Rs. 6 = Rs. 18	Rs.
or 1.5 lbs × Rs. 4 = 6	24

Labour

Machine Shop 7 hrs × Rs. 4 = Rs. 28	
Assembly Shop 2.5 hrs × Rs. 3.20 = 8	36
Overhead 33½ % of direct labour cost	12
Cost per unit	72
Profit (20 % on selling price or 25 % on cost)	18
Selling price per unit	90

- It has been assumed that all labour is direct labour

- The number of units of the product proposed to be sold

Total Sales revenue (given)	Rs. 1,26,00,000
Selling price (per unit)	Rs. 90
No of units of the product proposed to be sold (1,26,00,000 ÷ 90)	140000 units

- Statement showing purchases to be made of materials P and Q during the year in rupees.

<i>Material</i>	<i>Consumption (lbs)</i>	<i>Cl. Balance of material (lbs)</i>	<i>Op. Bal. of material (lbs)</i>	<i>Mat purchased lb (2)+(3)-(4)</i>	<i>Purchase Price Rs.</i>	<i>Amount Rs. (5)×(6)</i>
(1)	(2)	(3)	(4)	(5)	(6)	(7)
P	1,45,000* × 3 = 4,35,000	30,000	54,000	4,11,000	6	24,66,000
Q	1,45,000 × 1.5 = 2,17,500	66,000	33,000	2,50,500	4	10,02,000
Total						34,68,000

***Working Notes**

Number of finished units to be manufactured

= Sales (units) during the year + closing stock — Op. Stock

= 140,000 units + 25,000 units — 20,000 units

= 145,000 units

(c) Capacity utilization statement of Machine shop and Assembly shop.

	<i>Machine shop</i>	<i>Assembly shop</i>
(i) Hrs. available during year	600 persons × 1,840 hrs = 11,04,000 hrs	180 persons × 1,840 hrs = 3,31,200 hrs.
(ii) Hours required to manufacture 1,45,000 units		
(1,45,000 × 7 hrs)	10,15,000	
(1,45,000 × 2.5 hrs)		3,62,500 hrs.
(iii) Surplus/Deficit in hours	89,000	(31,300)
(iv) Capacity utilization	91.94%	109.45.

Comments. From the above it is clear that there are surplus hours in Machine shop accompanied by a deficit of 31,300 hours in Assembly shop. To resolve this problem, following suggestions are made:

(i) The excess labour force of Machine shop should be shifted to Assembly shop. The implementation of this suggestion does not present practical problems.

(ii) Assembly shop should resort to overtime working. Alternatively, fresh recruitment should be attempted. Both these ways will lead to increase in cost and reduction of profit of the Soloproducts Ltd.

Preparation of Cash Budget

Problem 11.13. Prepare a Cash Budget for the three months ending 30th June, 1986 from the information given below :

(a) Month	Sales	Var. costs	Wages	Overheads
	Rs.	P	Rs.	Rs.
February	14,000	9,600	3,000	1,700
March	15,000	9,800	3,000	1,900
April	16,000	9,800	3,200	2,000
May	17,000	10,000	3,600	2,200
Jun	18,000	10,400	4,000	2,300

Notes: All figures are

(i) Cash Debtors—80% sales are collected in the month and 20% of the credit sales are collected in the following month.

Creditors—Materials—1 month

Wages—1 month

Overheads—1 month

(c) Cash and Bank balance on 1st April, 1986 is expected to be Rs. 100.

(d) Other relevant information is :

- Plant and Machinery will be installed in February 1986 at a cost of Rs. 9,000. The monthly instalments of Rs. 2,000 is payable from April onwards.
- Dividend @ 5% on Preference Share Capital of Rs. 2,00,000 will be paid on 1st June.
- Advance to be received for sale of vehicles Rs. 9,000 in June.
- Dividends from investments amounting to Rs. 1,000 are expected to be received in June.
- Income tax (advance) to be paid in June, is Rs. 2,000.

(I.C.W.A. Inter, June 1986)

Solution.

Cash Budget

April—June-1986

	April	May	June	Total
Balance b/f	100	3,950	3,000	6,000
Receipts				
Sales (N.O.)	14,650	15,650	16,650	46,950
Dividend			1,000	1,000
Advance against vehicle			9,000	9,000
Total	20,650	19,600	29,650	62,950

3. Payments				
*Creditors	9,600	9,000	9,200	27,800
*Wages	3,150	3,500	3,900	10,550
*Overhead	1,950	2,100	2,250	6,300
Capital Exp.	2,000	2,000	2,000	6,000
Dividend on preference shares		—	10,000	10,000
Income tax Advance			2,000	2,000
Total	16,700	16,600	29,350	62,650
4. Balance c/f	3,950	3,000	300	300

Working Notes**Collection from Sales/Debtors**

Related month	Calculation	April Rs.	May Rs.	June Rs.
Feb.	(14,000—10% of 14,000) × 50%	6,300		
March	(15,000—10% of 15,000) × 50%	6,750	6,750	
April	10% of 16,000	1,600		
	(16,000—10% of 16,000) × 50%		7,200	7,200
May	10% of 17,000		1,700	
	(17,000—10% of 17,000) × 50%			7,650
June	10% of 18,000			1,800
		14,650	15,650	16,650

*Payments for creditors, wages and overhead have been computed on the same pattern.

Preparation of Production and Purchase Budgets

***Problem 11.14.** Manufacturers Ltd. produce three products from three basic raw materials in three departments. The company operates budgetary control system and makes its stock of finished goods on a total cost basis. From the following data, you are required to produce for the month of July 1986 the following budgets

- (a) Production (b) Material usage
(c) Purchases (d) Profit and loss account for each product and its total.

	Budgeted data for July 1986		
	Product		
	A	B	C
Sales	Rs. 15,00,000	Rs. 10,80,000	Rs. 16,80,000
Stock of finished products at July 1, 1986 in units	3,000	2,000	2,500

	<i>Department</i>		
	<i>I</i>	<i>II</i>	<i>III</i>
Production overhead	Rs. 2,39,000	Rs. 2,01,300	Rs. 3,91,200
Direct labour hours	47,800	67,100	65,200
	<i>Direct Material</i>		
	<i>M₁</i>	<i>M₂</i>	<i>M₃</i>
Stock at July 1, 1986 in units	24,500	20,500	17,500

The company is introducing a new system of inventory control, which should reduce stock. The forecast is that stocks as at 31st July 1986 will be reduced as follows. Raw materials by 10% and finished products by 20%.

Fixed production overhead is absorbed on a direct labour hour basis. It is expected that there will be no work-in-progress at the beginning or end of the month. Administration cost is absorbed by products at a rate of 20% of production cost and selling and distribution cost is absorbed by products at a rate of 40% of production cost.

Profit is budgeted as a percentage of total cost as follows :

Product *A* 25%, product *B* 12½% and product *C* 15½%

Standard cost data per unit of product :

		<i>Product</i>		
	Price per unit	<i>A</i>	<i>B</i>	<i>C</i>
<i>Direct Material</i>	Rs.	units	units	units
<i>M₁</i>	2.00	5	—	12
<i>M₂</i>	4.00	—	10	9
<i>M₃</i>	1.00	5	5	—
	Rate per hour			
<i>Direct wages :</i>	Rs.	Hrs.	Hrs.	Hrs.
<i>Department I</i>	2.50	4	2	2
<i>Department II</i>	2.00	6	2	3
<i>Department III</i>	1.50	2	4	6
<i>Other Variable costs</i>		Rs. 10	Rs. 20	Rs. 15

(C.A. Final, May 1986)

Solution.**Necessary Calculations****Statement showing total cost and selling price and sales in units for each product**

(Refer to Working Note 1)	Details	A	Details	B	Details	C
Materials		Rs.		Rs.		Rs.
M_1	(Rs. 2×5 units)	10		—	2×12	24
M_2		—	(4×10)	40	(4×9)	36
M_3	(Rs. 1×5 unit)	5	(1×5)	5		—
		<u>15</u>		<u>45</u>		<u>60</u>
Labour						
Deptt. I	(Rs. 2.5×4 unit)	10	(2.5×2)	5	(2.5×2)	5
Deptt. II	(Rs. 2.0×6 unit)	12	(2×2)	4	(2×3)	6
Deptt. III	(Rs. 1.5×2 unit)	3	(1.5×4)	6	(1.5×6)	9
Variable overhead		10		20		15
Fixed Cost (Refer to Working Note 2)						
Deptt. I	(Rs. 5×4 Hrs)	20	(5×2)	10	(5×2)	10
Deptt. II	(Rs. 3×6 Hrs)	18	(3×2)	6	(3×3)	9
Deptt. III	(Rs. 6×2 Hrs)	12	(6×4)	24	(6×6)	36
Total production cost		<u>100</u>		<u>120</u>		<u>150</u>
Adm. (Based on 20% of production cost)		20		24		30
Selling & Distt. Cost (40% of prod. cost)		<u>40</u>		<u>48</u>		<u>60</u>
Total Cost		<u>160</u>		<u>192</u>		<u>240</u>
Profit (25% on Cost)		40	$(12\frac{1}{2}\% \text{ of total cost})$	24	$(16\frac{2}{3}\% \text{ of total cost})$	40
Selling price		<u><u>200</u></u>		<u><u>216</u></u>		<u><u>280</u></u>
Sales in rupees		15,00,000		10,80,000		16,80,000
Sales in units		7,500		5,000		6,000
(Sales in rupees \div Selling price)		-----		-----		-----

(a) Production Budget for July 1986

	<i>A</i> (units)	<i>B</i> (units)	<i>C</i> (units)
Sales	7,500	5,000	6,000
Less Closing stock (Given)	1,000	2,000	2,500
	4,500	3,000	3,500
Add closing stock (20% reduction)	2,400	1,600	2,000
(Refer note 3) Production	6,900	4,600	5,500

(b) Material usage Budget for July 1986

Product (Unit of product)	<i>M₁</i>		<i>M₂</i>		<i>M₃</i>	
	Qty. per unit of product	Total Qty. reqd.	Qty. per unit of product	Total Qty. reqd.	Qty. per unit of product	Total Qty. reqd.
<i>A</i>	6,900	5	34,500	—	5	34,500
<i>B</i>	4,600	—	—	10	46,000	—
<i>C</i>	5,500	12	66,000	9	49,500	—
Total usage in unit		1,00,500		95,500		57,500

(c) Material Purchase Budget

	<i>M₁</i>		<i>M₂</i>		<i>M₃</i>	
	units	Rs.	units	Rs.	units	Rs.
Usage (Price is given)	1,00,500	201,000	95,500	3,82,000	57,500	57,500
Less/stock	24,500	49,000	20,500	82,000	17,500	17,500
	76,000	1,52,000	75,000	3,00,000	40,000	40,000
Add/(stock) (10% reduction)	22,050	44,100	18,450	73,800	15,750	15,750
	98,050	1,96,100	93,450	3,73,800	55,750	55,750

(d) Budget profit and loss account for each product and in total.

	<i>A</i>	<i>B</i>	<i>C</i>	Total
Sale	Rs. 15,00,000	Rs. 10,80,000	Rs. 16,80,000	42,60,000
Less cost (Refer to working notes)	12,00,000	9,60,000	14,40,000	36,00,000
Profit	3,00,000	1,20,000	2,40,000	6,60,000

Working Notes

Note 1. Price per unit of material and material units required for each product should be multiplied

Note 2. Fixed overhead rate

$$\text{Deptt I} = \frac{\text{Rs. } 2,39,000}{47,800} \text{ or Rs. 5 per hour,}$$

$$\text{Deptt II} = \frac{2,01,300}{67,100} \text{ or Rs. 3 per hour,}$$

$$\text{Deptt III} = \frac{\text{Rs. } 3,91,200}{65,200} = \text{Rs. 6 per hour,}$$

$$\text{Note 3. } A = \frac{3,000 \times 80}{100} \text{ or } 2,400, B = \frac{2,000 \times 80}{100} \text{ or } 1,600$$

$$C = \frac{2,500 \times 80}{100} \text{ or } 2,000$$

$$\text{Note 4. } A = 7,500 \times 160 \text{ or Rs. } 12,00,000; B = 5,000 \times 192 \text{ or Rs. } 9,60,000; C = 6,000 \times 240 \text{ or Rs. } 14,40,000$$

Production Budget

Problem 11-15. Ahead Ltd produces and sells a single product. Sales budget for calendar year 1987 by quarters is as under :

Quarter	No. of units to be sold
I	12,000
II	15,000
III	16,500
IV	18,000

The year is expected to open with an inventory of 4,000 units of finished products and close with an inventory of 6,500 units.

Production is customarily scheduled to provide for two-thirds of the current quarter's sales demand plus one-third of the following quarter's demand. Thus production anticipates sales volume by about one month.

The standard cost details for one unit of the product is as follows :

Direct materials 10 lbs @ 50 paise per lb.

Direct labour 1 hour 30 minutes @ Rs. 4 per hour

Variable overheads 1 hour 30 minutes @ Re 1 per hour

Fixed overheads 1 hour 30 minutes @ Rs. 2 per hour based on a budgeted production volume of 90,000 direct labour hours for the year.

(i) Prepare a Production Budget for 1987, by quarters, showing the number of units to be produced and the total costs of direct material, direct labour, variable overhead and fixed overheads.

(ii) If the budgeted selling price per unit is Rs. 17, what would be the budgeted profit for the year as a whole ?

(iii) In which quarter of the year, is the company expected to break-even? [C.A. Inter, May 1986]

Suggested Approach. First of all production budget should be prepared keeping in view that production should provide for (i) two-third of current quarter's sales demand and (ii) one-third for following quarters demand. It should be noted that closing inventory of 4th quarter has been given. The total cost for each quarter should be found out. Then cumulative result for the year and sales required to break-even can be found out.

Solution. (i) Look Ahead Ltd.,
Production Budget
 (For the year 1987 by quarters)

(a) Units to be produced in each quarters

	Quarter				
	I	II	III	IV	Total
$\frac{2}{3}$ of current quarter's sales demand	8,000	10,000	11,000	12,000	41,000
$\frac{1}{3}$ of the following quarter demand in I, II and III quarters. For IVth quarter inventory is given.	5,000	5,500	6,000	6,500	23,000
	<u>13,000</u>	<u>15,500</u>	<u>17,000</u>	<u>18,500</u>	<u>64,000</u>

(b) Statement showing Direct material, variable overhead and fixed overhead

	Quarters				
	I	II	III	IV	Total
Units to be produced	13,000	15,500	17,000	18,500	64,000
Direct Material @ Rs. 5 per unit	Rs. 65,000	Rs. 77,500	Rs. 85,000	Rs. 92,500	Rs. 3,20,000
(Refer to Note 1)					
Direct labour @ Rs. 6 per unit	78,000	93,000	1,02,000	1,11,000	3,84,000
(Refer to Note 2)					

Variable overhead @ Rs. 1'50 per unit (Refer to Note 3)	19,500	23,250	25,500	27,750	96,000
Fixed overhead (Refer to note 4)	45,000	45,000	45,000	45,000	1,80,000
	<u>2,07,500</u>	<u>2,38,750</u>	<u>2,57,500</u>	<u>2,76,250</u>	<u>9,80,000</u>

(ii) Budgeted profit for the whole year

Sales (61,500* units @ Rs. 17 per unit)	Rs. 10,45,500
Less : Total variable cost per unit (61,500 unit @ Rs. 12'50 per unit)	Rs. 7,68,750
	<u>2,76,750</u>
Less : Fixed cost	<u>1,80,000</u>
Profit for the whole year	<u>96,750</u>

*Sales for the year is given, i.e.,
 $12,000 + 15,000 + 16,500 + 18,000 = 61,500$ unit

Variable cost per unit	Rs.
Direct Material cost (Refer to Note 1)	5'00
Direct labour cost (Refer to Note 2)	6'00
Variable cost (Refer to Note 3)	<u>1'50</u>
	<u>12'50</u>

(iii) $BES \times P/V \text{ ratio} = \text{Fixed cost}$

$$\text{or } BES \times \frac{(Rs. 17 - Rs. 12'50)}{17} = Rs. 1,80,000$$

$$\text{or } Rs. 6,80,000$$

$$BE \text{ Sales in units} = \frac{Rs. 6,80,000}{17} \text{ or } 40,000 \text{ units.}$$

The total sales by the end of third quarter will be 43,500 units, i.e. $12,000 + 15,000 + 16,500$. Therefore, the company will break-even in the later part of the third quarter.

Working Notes

1. Direct material cost = 10 lbs @ Re. 0'50 per lb or Rs. 5'00 per unit

2. Direct labour per unit=1 hr. 30 minute @ Rs. 4 per hour or Rs. 6 per unit

3. Variable overhead per unit=1 hr. 30 minute @ Re 1 per hour or Rs. 1.50 per unit

4. Fixed Overhead

Budgeted production volume=90,000 direct labour hours for the year @ Rs. 2 per hour, i.e., Rs. 1,80,000 for the year. This fixed overhead is spread over the four quarters equally.

Preparation of Production Cost Budget

Problem 11.16. The following are the details of the budgeted and the actual cost in a factory for 6 months from January to June, 1980. From the figures given below you are required to prepare the production cost budget for the period from January to June 1981 :

	Jan. to June 1980	
	Budget	Actual
Production (units)	20,000	18,000
Material cost	Rs. 40,00,000 (2,000 M.T. @ Rs. 2,000)	Rs. 39,90,000 (@Rs. 2,100)
Labour cost	Rs. 8,00,000 (@ Rs. 20 per hour)	Rs. 7,99,920 (Rs. 22 per hour)
Variable overheads	Rs. 2,40,000	Rs. 2,16,000
Fixed overheads	4,00,000	4,20,000

In the first half of 1981, production is budgeted for 25,000 units. Material cost per tonne will increase from last year's actual by Rs. 100, but it is proposed to maintain the consumption efficiency of 1980 as budgeted.

Labour efficiency will be lower by another 1% and labour rates will be Rs. 22 per hour variable and fixed overheads will go up by 20% over 1980 actual.

You are required to prepare the production cost budget for the period January—June 1981, giving all the workings.

(C.A. Final, Nov. 1980)

Solution : **Production Cost Budget**
(for the 6 months ending 30th June, 1981)

Production (units)	25,000	
Details	Total cost	Cost per unit
Material cost (Note 1)	Rs. 55,00,000	Rs. 220.00
Labour cost (Note 2)	11,22,000	44.88

Variable overheads (Note 3)	3,60,000	14'40
Fixed overheads (Note 4)	5,04,000	20'16
	<hr/>	<hr/>
Total Budgeted cost	74,86,000	299'44
	<hr/>	<hr/>

Working Notes :**1. Material cost :**

Budgeted consumption per unit = $2,000 \text{ MT} \div 20,000$, or $0'10 \text{ MT}$

Anticipated material rate for first half of 1981 = Last year's actual rate + Rs. 100

= Rs. 2,100 + Rs. 100

= Rs. 2,200 per MT

(Materials cost in the question refers to material rate only).

Material cost for 25,000 units = $0'10 \times 25,000 \times 2,200$

= Rs. 55,00,000

2. Labour cost :

For first half of 1980 :

Budgeted labour hours = Rs. 8,00,000 \div 20

= 40,000 hours

Budgeted labour hours per unit = $40,000 \div 20,000$

= 2 hours

Actual labour hours = $7,99,920 \div 22$

= 36,360 hours

Actual labour hours per unit = $36,360 \div 18,000 = 2'02 \text{ hours}$

Difference between actual labour hours per unit and budgeted labour hours per unit = $2'02 - 2'0 = 0'02$

Negative efficiency % = $\frac{0'02}{2'0} = 1\%$

The actual efficiency has gone down by 1% in the first half of 1980 as compared to the budgeted efficiency. In other words, workers have taken more time in the actual period for producing one unit.

For first half of 1981 :

Budgeted labour hours per unit as worked out above = 2'00

Add : 1% negative efficiency in the actuals 0'02

Labour efficiency will be lower by another 1%. Thus extra time required (1% of 2'00) 0'02

2'04

Total labour hours required for 25,000 units = $25,000 \times 2.04$
= 51,000 hours

Labour cost @ Rs. 22 per hour = $51,000 \times 22$ = Rs. 11,22,000

3. **Variable overheads :**

Actual variable overhead rate per unit = $\frac{\text{Rs. } 2,16,000}{18,000}$
= Rs. 12 per unit

Increase by 20% over 1980 actuals = $\frac{12 \times 20}{100}$ = Rs. 2.40 per unit

1981 revised rate = Rs. 14.40 per unit

Total variable overheads for 1981 = $25,000 \times \text{Rs. } 14.40$
= Rs. 3,60,000

4. **Fixed overhead :**

Total actual fixed overhead for 1980 = Rs. 4,20,000

Add : 20% = 84,000

Revised fixed overhead for 1981 = 5,04,000

Preparation of Cash Budget

Problem 11.17. (a) The following information relates to XY Limited.

Month	Wages incurred Rs. '000	Material purchases Rs. '000	Overhead Rs. '000	Sales Rs. '000
February	6	20	10	30
March	8	30	12	40
April	10	25	14	60
May	9	35	14	50
June	12	30	18	70
July	10	25	16	60
August	9	25	14	50
September	9	30	14	50

(i) It is expected that the cash balance on 31st May will be Rs. 22,000.

(ii) The wages may be assumed to be paid within the month they are incurred.

(iii) It is the company policy to pay creditors for material three months after receipt.

(iv) Debtors are expected to pay two months after delivery.

(v) Included in overhead figure is Rs. 2,000 per month which represents depreciation on two cars and one delivery van.

(vi) There is one month delay in paying the overhead expenses.

(vii) 10% of the monthly sales are for cash and 90% are on credit.

(viii) A commission of 5% is paid to agents on all the sales on which this is not paid until the month following the sales to which it relates. This expense is not included in the overhead figure shown.

(ix) It is intended to repay a loan of Rs. 25,000 on 30th June.

(x) Delivery is expected in July of a new machine costing Rs. 45,000 of which Rs. 15,000 will be paid at delivery and Rs. 15,000 in each of the following months.

(xi) Assume that overdraft facility is available if required.

You are required to prepare a cash budget for each of the three months of June, July and August.

(b) "Experts stress that one of the most vital uses of management accounts is to regularly monitor cash flow moneys coming into the Company each month minus moneys going out—Financial Times—8th March 1983"—You are required to comment on the above statement and include in your answer the chief benefits obtained from the preparation of cash budgets.

(ICMA, London, May 1985—Adapted)

Solution.

(a)	Cash Budget		(Rs. in thousands)
	June	July	August
Balance b/d	22·00	1·75	(16·4)
Debtors	54·00	45·00	63·00
Cash	7·00	6·00	5·00
	<hr/> 83·00	<hr/> 52·75	<hr/> 51·60
Payments			
Material	30·00	25·00	35·00
Wages	12·00	10·00	9·00
Overhead	12·00	16·00	14·00
Commission	2·25	3·15	2·70
Loans	25·00	—	—
Machines	—	15·00	15·00
	<hr/> 81·25	<hr/> 69·15	<hr/> 75·7
Balance c/d	<hr/> 1·75	<hr/> (16·4)	<hr/> (24·1)

(b) It has been very well recognised these days that liquidity (cash position) of a business is of vital importance and no management can

afford to neglect this aspect without threat of extinction. Failure to meet the cash obligations can drive a business to closure. These days final accounts include source and application of Fund Statement. This practice stresses the need to ensure the sound liquid position of a business. Many internationally renowned companies have become insolvent due to failure to keep sufficient funds to maintain their operations.

Preparation of Production and Direct Wages Budgets

Problem 11.18. ACE Ltd manufactures three products A, C and E in two production departments F and G, in each of which are employed two grades of labour. The cost accountant is preparing the annual budgets for the next year and he has asked you to prepare, using the data given below :

(a) the production budget in units for products A, C and E.

(b) the direct wages budget for departments F and G with the labour costs of products A, C and E and total shown separately :

	Product A (Rs. '000)	Product C (Rs. '000)	Product E (Rs. '000)	
Finished stocks :				
Budgeted stocks are				
1st Jan.—next year	720	540	1,800	
31st Dec.—next year	600	570	1,000	
All stocks are valued at				
standard cost per unit	Rs. 24	Rs. 15	Rs. 20	
Standard Profit :				
<i>Calculated as percentage of selling price</i>				
	20%	25%	16½%	
	Total (Rs. '000)	Product A (Rs. '000)	Product C (Rs. '000)	Product E (Rs. '000)
Budgeted sales are :				
South	6,600	1,200	1,800	3,600
West	5,100	1,500	1,200	2,400
North	6,380	1,500	800	4,080
	<hr/> 18,080 <hr/>	<hr/> 4,200 <hr/>	<hr/> 3,800 <hr/>	<hr/> 10,080 <hr/>
Normal loss in production		10%	20%	5%
Standard labour times per unit and standard rates per hour :				
	Rate Rs.	Product A Hours per unit	Product C Hours per unit	Product E Hours per unit
Department F :				
Grade 1	1.80	2.0	3.0	1.0

Grade 2	1'60	1'5	2'0	1'5
Department G :				
Grade 1	2'00	3'0	1'0	1'0
Grade 2	1'80	2'0	1'5	2'5

(C.A. Final, May 1987)

Solution.**Working Notes****(i) Unit Selling price**

	Product A Rs. 24	Product C Rs. 15	Product E Rs. 20
Cost per unit			
<i>Add : Profit</i>			
20% of S.P. or 25% of cost	6		
25% of S.P. or $\frac{1}{3}$ of cost		5	
16 $\frac{2}{3}$ % of S.P. or 20% of cost			4
Selling price per unit	<u>30</u>	<u>20</u>	<u>24</u>

(ii) Budgeted sales

(Rs.)	Rs. 42,00,000	Rs. 38,00,000	Rs. 1,00,80,000
(Budgeted sales in units)	1,40,000	1,90,000	4,20,000
(Budgeted sales ÷ unit S.P.)			

(iii) Accretion/ Decretion in Stock

1st Jan.	Rs. 7,20,000	Rs. 5,40,000	18,00,000
31st Dec.	<u>6,00,000</u>	<u>5,70,000</u>	<u>10,00,000</u>

(iv) Accretion/

(Decretion) (in Rs).	(1,20,000)	30,000	(8,00,000)
Standard price	Rs. 24	Rs. 15	Rs. 20

(v) Accretion/Decretion in stock in unit	(5,000)	2,000	(40,000)
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$$(iii) \times (i) \div (iii) \times (ii)$$

(a) Production in units for products A, C, E

	A	C	E
Budgeted sales (in units)	1,40,000	1,90,000	4,20,000
Accretion/Decretion in stock in units	(5,000)	2,000	(40,000)
Good units produced	<u>1,35,000</u>	<u>1,92,000</u>	<u>3,80,000</u>

% of loss in production	10% of input or $\frac{1}{3}$ of output	20% of input or $\frac{1}{3}$ of output	5% of input or $\frac{5}{8}$ of output
--------------------------------	--------------------------------------------	--------------------------------------------	-------------------------------------------

Loss in production (in units)	15,000	48,000	20,000
*Input to production	1,50,000	2,40,000	4,00,000

*Production as per budget in units.

(b) Direct Wages Budget for Department F and G (with labour costs of product A, C, E and total)

	Product A		Product C		Product E		Total
	Std. Hrs. (‘000)	Rs. ‘000	Std. Hrs. ‘000	Rs. ‘000	Std. Hrs. ‘000	Rs. ‘000	Rs. ‘000
<i>Department F</i>							
<i>Grade 1</i>							
@ Rs. 1.80 per hr.	300*	540	720	1296	400	720	2,556
<i>Grade 2</i>							
@ 1.60	225	360	480	768	600	960	2,088
Total (A)		900		2,064		1,680	4,644
<i>Department G</i>							
<i>Grade 1</i>							
@ Rs. 2.00	450	900	240	480	400	800	2,180
<i>Grade 2</i>							
@ Rs. 1.80	300	540	360	648	1,000	1,800	2,988
Total (B)		1,440		1,128		2,600	5,168
Total (A+B)		2,340		3,192		4,280	9,812

*1,50,000 units × 2 Hrs = 3,00,000 hrs. Other values have been determined in the same manner.

Preparation of Man-power Budget

Problem 11.19. The direct labour hour requirements of three of the products manufactured in a factory, each involving more than one labour operation, are estimated as follows.

Direct labour hours per unit (in minutes)

	Product		
Operation	1	2	3
I	18	42	30
II	—	12	24
III	9	6	—

The factory works 8 hours per day, 6 days in a week. The budget quarter is taken as 13 weeks and during a quarter, lost hours due to leave and holidays and other causes are estimated to be 124.

The budgeted hourly rates for the workers manning the operations I, II and III are Rs. 2.00, Rs. 2.50 and Rs. 3.00 respectively.

The budgeted sales of the products during the quarter are :

Product 1	9,000 units
2	15,000 units
3	12,000 units

There is a carry-over of 5,000 units of Product 2 and 4,000 units of Product 3 and it is proposed to build up a stock at the end of the budget quarter as follows :

Product 1	1,000 units
3	2,000 units

Prepare a man-power budget for the quarter showing for each operation :

- (i) direct labour hours, (ii) direct labour cost, and
(iii) the number of workers. (I C.W.A. Final, June 1980)

Solution.

(a)

Production Budget
For the quarter ending.....

Details	Products		
	1	2	3
Budgeted sales (units)	9,000	15,000	12,000
Add : Stock to be built up (closing)	1,000	--	2,000
Total	10,000	15,000	14,000
Less : Carryover stock (opening)	—	5,000	4,000
Budgeted Production	10,000	10,000	10,000

(b) *Direct labour hour for each product operation-wise.*

(i) Operation I	Product 1	Product 2	Product 3
Direct labour hrs. per unit	18 minutes	42 minutes	30 minutes
Budgeted production in units	10,000	10,000	10,000
Direct labour hrs. required	$\frac{10,000 \times 18}{60}$ = 3,000 hrs.	$\frac{10,000 \times 42}{60}$ 7,000 hrs.	$\frac{10,000 \times 30}{60}$ 5,000 hrs.
Total labour hours required for operation I	15,000 hours		

(ii) Operation II

	Products		
	1	2	3
Direct labour hours per unit	—	12 minutes	24 minutes
Budgeted production (units)	10,000	10,000	10,000
Direct labour hours required	—	$\frac{10,000 \times 12}{60}$	$\frac{10,000 \times 24}{60}$
	= —	2,000 hrs.	4,000 hrs.
Total labour hours required for operation II	6,000 hours		

(iii) Operation III

	Products		
	1	2	3
Direct labour hrs. per unit	9 minutes	6 minutes	—
Budgeted production (units)	10,000	10,000	10,000
Direct labour hours required	$\frac{10,000 \times 9}{60}$	$\frac{10,000 \times 6}{60}$	—
	= 1,500 hrs.	1,000 hrs.	—
Total labour hours required for operation II	2,500 hours		

(c) Number of workers required for cash operation

First find out the total available hours per man for a quarter

Working of the factory in a quarter
 13 weeks \times 6 days week
 \times 8 hours a day
 = 624 hours

Less : Loss of hours due to leave, holidays and other causes

124 hours

Total available hours per man

500 hours

Now, requirements for manpower for each operation can be worked out

Manpower requirement :

(a) Operation I Total direct labours hrs. \div Total available hours required per man

= $15,000 \div 500$ or 30 men

(b) Operation II = $6,000 \text{ hrs.} \div 500$ or 12 men

(c) Operation III = $2,500 \text{ hrs.} \div 500$ or 5 men

Now, manpower budget for the quarter can be prepared for the three products and for each operation. The same is given below :

Operation	Hourly rate	Product 1		Product 2		Product 3		Total		No. of workers
		D.L.	Cost	D.L.	Cost	D.L.	Cost	D.L.	Cost	
		Rs.	Hrs.	Rs.	Hrs.	Rs.	Hrs.	Rs.	Hrs.	
I	2'00	3,000	6,000	7,000	14,000	5,000	10,000	15,000	30,000	30
II	2'50	—	—	2,000	5,000	4,000	10,000	6,000	15,000	12
III	3'00	1,500	4,500	1,000	3,000	—	—	2,500	7,500	5
Total		4,500	10,500	10,000	22,000	9,000	20,000	23,500	52,500	47

Problem 11-20. (Functional Budgets) Carryon Ltd. manufactures two products *B* and *T*. It is going to prepare its budget for the year ending 31st December 1988. Expectations for 1988 include the following :

(a) Opening Balances		Rs.	Rs
Fixed Assets :			
Land		20,000	
Buildings and plant		150,000	
Cumulative depreciation		(60,000)	
			1,10,000
Current Assets :			
Stocks : Raw Materials		3,000	
<i>B</i>		3,400	
<i>T</i>		7,200	
		13,600	
Debtors		45,000	
Cash/Bank		10,000	
		68,600	
Less : Current Liabilities			
Creditors		29,000	
Taxation		28,000	
		57,000	11,600
			1,21,600
Represented by			
Share Capital		71,600	
Retentions		50,000	1,21,600
(b) Finished Products		<i>B</i>	<i>T</i>
Budgeted Sales (units)		5,000	1,000
Budgeted selling price (per unit)		Rs. 30	Rs. 50
Opening Stock of finished goods (in units)		200	300
Budgeted closing stock (in units)		1,200	200

(i) Direct Materials	P	Q
Raw Material per unit of production		
<i>B</i>	5 kg	3 kg
<i>T</i>	2 kg	4 kg
Opening stock of Raw materials	2000 kg	2000 kg
Budgeted closing stocks	2500 kg	1500 kg
Cost per kg of material purchased	Re. 0.50	Re. 1.00

(ii) Direct Labour :

Labour is paid at the rate of Rs. 2 per hour. 3 direct labour hours are required to produce one unit of *B* and 5 labour hours are required for one unit of *T*.

(iii) Factory Overheads :

It has been estimated that factory overheads will be Rs. 33,750 including Rs. 11,750 for depreciation. Factory Overheads are absorbed on a direct labour hour basis.

(iv) Work in progress :

This is negligible and can be ignored (*i.e.*, no opening or closing stocks).

(b) Administration Overheads

These are estimated to be Rs. 11,625. They are charged to goods leaving work in progress and entering finished goods stocks and are absorbed as a percentage of factory cost.

(c) Selling and Distribution Overheads

These are estimated to be Rs. 20,000. They are charged to the cost of sales on the basis of a percentage of the selling price.

(f) Stock Pricing

Goods are priced on a FIFO basis. Opening stock of raw materials are 2000 kg of *P* at Re. 0.50 (Rs. 1,000) and 2,000 kg of *Q* at Re. 1 (Rs. 2,000).

(g) Taxation in 1988. Profit is estimated at Rs. 30,000. Overdraft Interest in 1988 is expected to be Rs. 595, Rs. 500 of which will be paid during the third quarter of the year.

You are required to prepare the following budgets for 1988 for Carryon Ltd using absorption costing methods :

(a) Sales budget.

(b) Production budget (quantities only) ;

(c) Direct Materials budget (usage and purchases) ;

(d) Direct Labour budget ;

(e) Overhead absorption rate ;

(f) Closing stock budget ;

(g) Cost of goods sold budget ;

(h) Budgeted Profit and Loss Account. (*I.C.W.A. Final, December 1987*)

Solution. Products	(a) Sales Budget Budgeted Sales Quantity	Selling Price	Sales
B	5,000	Rs. 30	Rs. 1,50,000
T	1,000	Rs. 50	50,000
			<u>2,00,000</u>

(b) Production Budget (Quantities)

	B	T
Sales (in Unit)	5,000	1,000
Add : Closing Stock	1,200	200
	<u>6,200</u>	<u>1,200</u>
Less : Opening Stock	200	300
	<u>6,000</u>	<u>900</u>
Production required		

(c) Direct Materials Budget

(i) Quantity required for units produced.	P	Q
(6,000 × 5 kg)	30,000	
(900 × 2 kg)	1,800	
(6,000 × 3 kg)		18,000
(900 × 4 kg)		3,600
	<u>31,800</u>	<u>21,600</u>
Add : Closing Stock	2,500	1,500
	<u>34,300</u>	<u>23,100</u>
Less : Opening Stock	2,000	2,000
	<u>32,300</u>	<u>21,100</u>
Material required (in kg.)		

Cost per kg	Rs. 0'50	Rs. 1'00
Total	Rs. 16,150	Rs. 21,100
Total Material Cost as per Budget=	Rs. 37,250	
(Rs. 16,150 + Rs. 21,100)		

(d) Direct Labour Budget

Product	Production in Units	L. Hrs reqd.	Total hrs reqd.	Rate	Labour Cost
B	6,000	3	18,000	Rs. 2	Rs. 36,000
T	900	5	4,500	Rs. 2	9,000
			<u>22,500</u>		<u>45,000</u>

(e) (i) Overhead Absorption Rate

Budgeted Factory O.H.

Rs. 33,750

Budgeted Hours

22,500

Budgeted Factory O. Rate = Rs. 1'5 per labour hour

(ii) *Factory Cost of goods produced*

<i>Direct Material</i>	<i>B</i>	<i>T</i>
P ($6,000 \times 5 \text{ kg} \times 0.50$)	Rs. 15,000 ($900 \times 2 \times 0.50$)	Rs. 900
Q ($6,000 \times 3 \text{ kg} \times 1.00$)	18,000 ($900 \times 4 \times 1.00$)	3,600
	<hr/>	<hr/>
Direct Material	33,000	4,500
Direct Labour	36,000	9,000
<i>Factory O.H.</i>		
18,000 $\times 1.5$	27,000 4,500 $\times 1.5$	6,750
	<hr/>	<hr/>

Factory cost of goods sold Rs. 96,000 Rs. 20,250

(iii) *Administration Overhead*

Estimated	Rs. 11,625
Factory Cost	Rs. 1,16,250
(Rs. 96,000 + Rs. 20,250)	
\therefore Adm O.H. is 10% of factory cost	
Adm. O.H. for Product T (10% of Rs. 96,000)	= Rs. 9,600
Adm. OH for Product T (10% of Rs. 20,250)	= Rs. 2,025
	<hr/>
	11,625

(iv) *Selling and Distribution Overhead*

Budgeted S & D Overheads	Rs. 20,000
Budgeted Sales :	
B 5,000 \times Rs. 30 = Rs. 1,50,000	
T 1,000 \times Rs. 50 = 50,000	Rs. 2,00,000
	<hr/>
\therefore S & D overhead is 10% of Sales.	
\therefore Selling O.H. for B = 10% of Rs. 1,50,000	= Rs. 15,000
Selling O.H. for T = 10% of Rs. 50,000	= 5,000
	<hr/>
Total Selling overhead.	20,000

(f) *Closing Stock Budget*

<i>(i) Raw material</i>	<i>P</i>	<i>Q</i>	
o/ Stock ($2,000 \text{ kg} \times 0.50$) = Rs. 1,000		($2,000 \text{ kg} \times 1.00$) =	Rs. 2,000
Purchases ($32,300 \times 0.50$) =	16,150	($21,100 \times 1.00$) =	21,100
	<hr/>		<hr/>
34,300 kg	17,150	23,100 kg	23,100
<i>Less : Consumption</i>			
($31,800 \times 0.50$)	15,900	($21,600 \times 1.00$) =	21,600
	<hr/>		<hr/>
2,500 kg	1,250	1,500 kg	1,900
	<hr/>		<hr/>

(ii) *Finished Goods*

	<i>B</i>	<i>T</i>
Add : Factory cost of production	Rs. 96,000	Rs. 20,250
Adm. overhead	9,600	2,025
	<hr/> 1,05,600	<hr/> 22,275
Units Finished	6,000	900
Cost per Unit	Rs. 17.60	Rs. 24.75

Statement showing Cost of Closing Stock of Finished Goods

	<i>Products</i>				
	<i>B</i>			<i>T</i>	
	<i>Units</i>	<i>Amount</i>		<i>Units</i>	<i>Amount</i>
Opening Stock	200	Rs. 3,400		300	Rs. 7,200
Addition	6,000	1,05,600		900	22,275
	<hr/> 6,200	<hr/> 1,09,000		<hr/> 1,200	<hr/> 29,475
Less : Cost of finished goods sold,					
From Opening Stock	(200)	(3,400)		(300)	(7,200)
Fresh units introduced & completed	(4,800)*			(700)*	
4,800 × 17.6		(84,480)			(17,325)
700 × Rs. 24.75					
Closing Stock	<hr/> 1,200	<hr/> 21,120		<hr/> 200	<hr/> 4,950

*Units Completed during the year—opening stock (FIFO method is used)

	<i>B</i>			<i>T</i>	
	<i>Units</i>	<i>Amount</i>		<i>Units</i>	<i>Amount</i>
From Op. Stock	200	Rs. 3,400		300	Rs. 7,200
Units introduced	4,800	84,480		700	17,325
Finished & sold	<hr/>	<hr/>		<hr/>	<hr/>

Cost of finishing the goods sold	5,000	87,880	1,000	24,525
Selling & Dist. overhead		15,000		5,000
Cost of goods sold		1,02,880		29,529
(h) Budgeted P and L A/c				
	<i>B</i>	<i>T</i>		<i>Total</i>
Sales	Rs. 1,50,000	Rs. 50,000		Rs. 2,00,000
Less : Cost of sales	1,02,880	29,525		1,32,405
Profit before tax and interest				67,595
Less : Interest				595
Profit before tax				
Tax				30,000
Profit after Tax				37,000

Preparation of Various Budgets leading to Cash Budget

***Problem 11'22.** RH Ltd is a new company which has planned to produce two products as detailed below :

	<i>Suloha</i> <i>Rs. unit</i>	<i>Unibla</i> <i>Rs. unit</i>
Direct materials	40	20
Direct wages	30	15
Variable overhead (excluding sales commission)	14	7
	84	42
Selling price	100	50

Fixed expenses excluding interest on bank overdrafts amount to Rs. 6,00,000 per annum and are expected to be incurred in equal amounts from 1st June 1984. The financial year commences from 1st July 1984 and the sales for June 1984 and the first four months of the year 1984-85 are as follows :

Month	Units of sales budgeted	
	Sulohi	Unibla
June 1984	4,400	2,100
July 1984	4,200	2,100
August 1984	4,600	2,300
September 1984	3,600	1,800
October 1984	4,000	2,000

Production. 75% of each month's sales will be produced in the month of sale and 25% of sales are produced in the previous month.

Sale. In case of Sulohi, the pattern of sales realisation is as under :

(a) One-third on cash basis on which a cash discount of 2% is allowed.

(b) One-third on documents against payment through bank. Such bills are discounted with the bank and credit is received in the month of sale itself.

(c) One-third on documents against acceptance and collected through bank. The cash under the scheme will be received in the third month. For example, the value of goods sold in September will be received in November. However, cash due in the month of July under this scheme was not received till October. In the case of Unibla, 80% of payment is received in the month of sales and the balance 20% in the next month.

Direct Material. 50% of the direct materials required for each month's production will be purchased in the previous month and the balance 50% in the month of production itself. The total requirement of direct material in October 1984 was estimated at Rs. 2,00,000. The payment for direct material purchases will be made in the month following the purchase.

Direct Wages. 80% Direct wages will be paid in the month of use of direct labour and the balance of 20% in the following month.

Variable Overhead. 50% to be paid in the month of use and the balance 50% in the next month.

Fixed Overhead. 40% of the fixed overheads will be paid in the month in which it is incurred and 40% in the following month. The balance of 20% represents depreciation of fixed assets.

Interest and Bank Charges. Interest is charged at the rate of 18% per annum on the overdrafts of each month but the bank debits interest at the end of each quarter namely on the last day of March, June, September and December. The charge for discounting bills is 0.5% which is debited in the same month by the bank.

Commission. A commission of 3% on the gross sales of Sulohi and 2% on the gross sales of Unibla is payable at the end of each quarter.

Cash. Cash in bank on 1st July 1984 is Rs. 1,00,000.

Build up the various budgets as required with a view to preparing a monthwise cash budget for the month of July, August and September 1984. Show the cash budget in a detailed form.

(I.C.W.A. Final, Dec. 1984)

Solution.

1. Production Budget

Sulohi

	<i>June</i>	<i>July</i>	<i>Aug.</i>	<i>Sept.</i>	<i>Oct.</i>
Sale units	4,400	4,200	4,600	3,600	4,000

Production

75% of this month's sales	3,300	3,150	3,450	2,700	3,000
25% of next month's sale	1,050	1,150	900	1,000	—
Total	4,350	4,300	4,350	3,700	3,000

Unibla

Sales	2,100	2,100	2,300	1,800	2,000
-------	-------	-------	-------	-------	-------

Production

75% of this month	1,575	1,575	1,725	1,350	1,500
25% of next month's sale	525	575	450	500	—
Total	2,100	2,150	2,175	1,850	1,500

2. Direct material costs budget

Sulohi @ Rs. 40	1,74,000	1,72,000	1,74,000	1,48,000	
Unibla @ Rs. 20	42,000	43,000	43,500	37,000	
Total	2,16,000	2,15,000	2,17,500	1,85,000	2,00,000 (Given)

3. Purchase Budget

50% in previous month	1,07,500	1,08,750	92,500	1,00,000	
50% of same month	1,08,000	1,07,500	1,08,750	92,500	
	2,15,500	2,16,250	2,01,250	1,92,500	
Payment		2,15,500	2,16,250	2,01,250	

4. Direct Wages Budget

	<i>June</i>	<i>July</i>	<i>Aug.</i>	<i>Sept.</i>	<i>Oct.</i>
Sulohi @ Rs. 30	1,30,500	1,29,000	1,30,500	1,11,000	
Unibla @ Rs. 15	31,500	32,250	32,625	27,750	
	<u>1,62,000</u>	<u>1,61,250</u>	<u>1,63,125</u>	<u>1,38,750</u>	
<i>Payments</i>					
80% this month	1,29,600	1,29,000	1,30,500	1,11,000	
20% next month		32,400	32,250	32,625	
		<u>1,61,400</u>	<u>1,62,750</u>	<u>1,43,625</u>	

5. Variable Overhead Budget

Sulohi @ Rs. 14	60,900	60,200	60,900	51,800	42,000
Unibla @ Rs. 7	14,700	15,050	15,225	12,950	10,050
	<u>75,600</u>	<u>75,250</u>	<u>76,125</u>	<u>64,750</u>	<u>52,050</u>
<i>Payment</i>					
50% same month	37,800	37,625	38,063	32,375	26,250
50% next month	—	37,800	37,625	38,062	32,375
		<u>75,425</u>	<u>75,688</u>	<u>70,437</u>	

6. Fixed Overheads Budget

Fixed overhead	50,000	50,000	50,000	50,000	50,000
<i>Payment</i>					
40% same month	20,000	20,000	20,000	20,000	20,000
40% following month	—	20,000	20,000	20,000	20,000
		<u>40,000</u>	<u>40,000</u>	<u>40,000</u>	
Total		<u>40,000</u>	<u>40,000</u>	<u>40,000</u>	

7. Sales Budget

	<i>June</i>	<i>July</i>	<i>Aug.</i>	<i>Sep.</i>	<i>Oct.</i>
Sulohi @ Rs. 100	4,40,000	4,20,000	4,60,000	3,60,000	4,00,000
Unibla @ Rs. 50	1,05,000	1,05,000	1,15,000	90,000	1,00,000
	<u>5,45,000</u>	<u>5,25,000</u>	<u>5,75,000</u>	<u>4,50,000</u>	<u>5,00,000</u>

Calculation of Receipts.**Sulohi.**

1/3rd on cash basis	1,40,000	1,53,333	1,20,000
Less : 2% cash discount	2,800	3,067	2,400
(a)	<u>1,37,200</u>	<u>1,50,266</u>	<u>1,17,600</u>

1/3rd on documents against payment through bank (b)	1,40,000	1,53,334	1,20,000
1/3rd on documents against acceptance and collected through bank	1,40,000	1,53,333	1,20,000
Actual collection (c)	—	1,46,667*	1,40,000
(A) Cash collection for Sulohi (a+b+c)	2,77,200	4,50,267	3,77,600

*one-third of sales of June, i.e., Rs. 4,40,000.

Unibla

80%	84,000	92,000	72,000
20%	21,000	21,000	23,000
(B) Cash collection for Unibla	1,05,000	1,13,000	95,000
Total collection for Sulohi and Unibla (A+B)	3,82,200	5,63,267	4,72,600

Discounting charges (0.5%) Refer to (b)	700	767	600
-----------------------------------------	-----	-----	-----

Commission

Sulohi 3% on gross sales on July, Aug. & Sept. i.e., Rs. 12,40,000	37,200
Unibla 2% on gross sales of July, Aug. & Sept. i.e. Rs. 3,10,000	6,200
Total	43,400

Cash Budget

For the quarter ending September 1984

	July Rs.	August Rs.	September Rs.
Opening Balance	1,00,000	(10,825)	56,987
Receipts	3,82,200	5,63,267	4,72,600
	4,82,200	5,52,442	5,29,587
Payments :			
Direct Materials	2,15,500	2,16,250	2,01,250
Direct Wages	1,61,400	1,62,750	1,43,625
Variable Overhead	75,425	75,688	70,437
Fixed Overhead	40,000	40,000	40,000

Bank charges	700	767	600
Commission			43,400
Interest	—	—	563*
	<u>4,93,025</u>	<u>4,95,455</u>	<u>4,99,875</u>
Closing balance	(10,825)	56,987	<u><u>29,712</u></u>

**Calculation of Interest*

$$(1) \quad \frac{10,825 \times 18 \times 1}{100 \times 12} = 162$$

$$(2) \quad \frac{(4,99,312 - 4,72,600) \times 18 \times 1}{100 \times 12} = 401$$

$$\begin{array}{r} \text{---} \\ 563 \\ \text{==} \end{array}$$

Preparation of Production, Material Requirement and Material Purchase Budgets

Problem 11'23. Chemicals Ltd. manufacture two products *AB* and *CD* by mixing the following raw materials in the proportion shown :

Raw Material	Product <i>AB</i>	Product <i>CD</i>
<i>A</i>	80%	
<i>B</i>	20%	
<i>C</i>		50%
<i>D</i>		50%

The finished weight of products *AB* and *CD* are equal to the weight of their ingredients. During the month of June, it is expected that 60 tons of *AB* and 200 tons of *CD* will be sold.

Actual and budgeted inventories for the month of June are as follows :

Material	Actual Inventory (1st June) Quantity (Tons)	Budgeted Inventory (30th June) Quantity (Tons)
<i>A</i>	15	20
<i>B</i>	10	40
<i>C</i>	200	300
<i>D</i>	250	200
Product <i>AB</i>	10	5
Product <i>CD</i>	50	60

The purchase price of materials for June is expected to be as follows :

<i>Material</i>	<i>Cost per ton</i>
	Rs.
<i>A</i>	500
<i>B</i>	400
<i>C</i>	100
<i>D</i>	200

All materials will be purchased on 3rd of June. Prepare :

(a) The Production Budget for the month of June.

(b) The Material Requirement Budget for June.

(c) The Material Purchase Budget indicating the expenditure for materials for the month of June. *(I.C.W.A. Final, June 1986)*

Solution.

(a) We know that :

Opening stock of finished good + Production -- Sales + closing stock of finished goods

or Production -- Sales + Closing stock of finished goods -- Opening stock of finished goods.

Production Budget (June)

	<i>Product AB</i>	<i>Product CD</i>
	Tons	Tons
Sales	60	200
Add : Closing finished stock	5	60
	-----	-----
Total requirement	65	260
Less : Opening finished stock	10	50
	-----	-----
Production	55	210
	-----	-----

(b) **Material Requirement Budget (June) :**

	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>
	Tons	Tons	Tons	Tons
<i>Required for production :</i>				
Product AB—55 tons				
(A 80% : B 20%)	44	11		
Product CD—210 tons				
(C 50% : D 50%)	—	—	105	105
Closing stock	20	40	300	200
	-----	-----	-----	-----
Total requirement	64	51	405	305
Less : Opening stock	15	10	200	250
	-----	-----	-----	-----
Materials to be purchased	49	41	205	55
	-----	-----	-----	-----

(c) Material Purchased Budget (June)

<i>Materials</i>	<i>Quantity</i>	<i>Rate</i>	<i>Value</i>
	<i>Tons</i>	<i>Rs.</i>	<i>Rs.</i>
<i>A</i>	49	500	24,500
<i>B</i>	41	400	16,400
<i>C</i>	205	100	20,500
<i>D</i>	55	200	11,000
			<hr/> 72,400 <hr/>

Preparation of Production, Purchase, Production Costs and Cash Budgets

***Problem 11-24.** The following data relate to Product Aye :
Budgeted Data

	1st October to 31st December, 1985			1st January, to 31st March, 1986		
Sales Division	1	2	3	1	2	3
Sales of Aye Rs.	54,000	3,42,000	2,28,000	60,000	3,60,000	2,40,000
Stocks of Aye :						
Opening units	90	320	260	100	350	250
Maximum units	150	500	350	150	500	350

Sales and production occur evenly each month during each budget quarter.

Debtors pay for sales in the month following that when sales occur.

Creditors are paid for materials in the second month following that when purchases occur.

On an average, overhead incurred is paid for within the month following that in which incurred.

Wages are paid in the same month as earned.

Cash balance on 31st December, 1985, Rs. (18,000).

Corporation tax of Rs. 50,000 is payable in January 1986.

Special advertising campaign expenditure of Rs. 60,000 is due in March 1986.

Standard Cost Data

Direct Materials	DM1	10 kilos @ Rs. 3 per kilo
	DM2	5 kilos @ Rs. 2 per kilo
Direct Wages	DW1	5 hours @ Rs. 4 per hour
	DW2	2 hours @ Rs. 5 per hour

Profit (10% on selling price or $\frac{1}{5}$ of cost)	20
Selling price	200

(ii) Sales Jan.	Rs. 60,000
Feb.	3,60,000
March	2,40,000

$$\frac{6,60,000}{\div \text{Rs. } 200} = 3300 \text{ units}$$

(a) Production Budget

Sales			
+ Closing stock	Division 1	150	
	Division 2	500	
	Division 3	350	1,000

			4,300
- Opening stock	Division 1	100	
	2	350	
	3	250	700

			3,600 units

(b) Purchases. Purchases will take into account maximum stock level.

Maximum level = Reorder level + Reorder quantity - minimum consumption during the period.

Reorder level = Maximum usage \times Maximum reorder period

For DM1	= 3600 \times 6	= 21,600
DM2	= 1800 \times 5	= 9,000

Minimum usage in reorder period is :

For DM1	= 2400 \times 4	= 9,600
DM2	= 1200 \times 3	= 3,600

\therefore Maximum levels, therefore, based on the formula given above

DM1	21,600 + 20,000 - 9,600 = 32,000
DM2	9,000 + 12,000 - 3,600 = 17,400

	DM1	DM2
Desired stock	32,000	17,400

Production		
36,00 \times 10	36,000	3600 \times 5 18,000

	68,000	35,400
--	--------	--------

Less : Opening stock	23,000	14,400
----------------------	--------	--------

	45,000 kg.	21,000 kg
--	------------	-----------

Price per kg	Rs. 3	Rs. 2
	<u>1,35,000</u>	<u>42,000</u>

Total Purchase Budget Rs. 1,77,000

(c) Production cost for 3,600 units

<i>Material</i>		Rs.	Rs.
DM1	3,600 × Rs. 30	1,08,000	
DM2	3,600 × Rs. 10	<u>36,000</u>	1.44,000
<i>Labour</i>			
DW1	3,600 × Rs. 20	72,000	
DW2	3,600 × Rs. 10	<u>36,000</u>	1.08,000
<i>Overhead</i>			
PO1	3,600 × 60	2,16,000	
PO2	3,600 × 20	<u>72,000</u>	2.88,000
			<u>5,40,000</u>

Cash for each of three months

	Jan.	Feb.	March
Opening/Balance	(18,000)	(21,000)	26,000
Received from Sales :			
1/3rd of Rs. 6,24,000	2,08,000		
1/3rd of Rs. 6,60,000		2,20,000	
1/3rd of Rs. 6,60,000			2,20,000
	<u>1,90,000</u>	<u>1,99,000</u>	<u>2,46,000</u>
Payments :			
Direct Material (Refer to Note 1)	41,000	41,000	59,000
Direct wages 1/3 (3,600 × 30)	36,000	36,000	36,000
Production overhead (Note 2)	84,000	96,000	96,000
Corporate tax	50,000	—	—
Special advertising	—	—	60,000
	<u>2,11,000</u>	<u>1,73,000</u>	<u>2,51,000</u>
Balance carried forward	(21,000)	26,000	(5,000)

Note 1. Production in Dec. quarter

Sales Division	1	54,000
	2	3,42,000
	3	2,28,000
		<hr/>
		6,24,000 ÷ 200
		= 3,120 units
Sales		3,120 units
Add : Closing stock (100 + 350 + 250)		700
		<hr/>
		3,820
Less : Opening stock (90 + 320 + 260)		670
		<hr/>
Production		3,150

Purchases

	DM1		DM2
3,150 units × 10	31,500	3150 × 5	15,750
+ closing stock	23,000		14,400
- opening stock	(24,500)		(13,650)
	<hr/>		<hr/>
	30,000		16,500
	× Rs. 3		× Rs. 2
	<hr/>		<hr/>

Rs. 90,000

Rs. 33,000

Rs. 1,23,000 for quarter ÷ 3 = Rs. 41,000 for Jan. and Feb.

Purchase Budget for March quarter = Rs. 1,77,000 ÷ 3 = Rs. 59,000 March.

Note 2.**Production Overhead**

For first quarter 3,150 units × Rs. 80

= Rs. 2,52,000 ÷ 3 = Rs. 84,000 for Jan.

Production overhead for second quarter

= 3,600 × Rs. 80 = Rs. 2,88,000 ÷ 3 = Rs. 96,000 for Feb. and March.

BUDGETED INCOME STATEMENT**Comprehensive Budget**

***Problem 11·25.** The following is the sales budget of a company engaged in manufacturing and marketing certain consumer products (in 3 lines), their market being Eastern and Western Zones :

Product	Eastern		Western		(Rs. in lakhs) Total	
	Units	Rs.	Units	Rs.	Units	Rs.
A	30,000	15·00	16,000	8·00	46,000	23·00
B	10,000	6·00	15,000	9·00	25,000	15·00
C	4,000	3·20	6,000	4·80	10,000	8·00
		<hr/>		<hr/>		<hr/>
		24·20		21·80		46·00
		<hr/>		<hr/>		<hr/>

No changes are expected in the inventory levels. The following are the unit standard cost details for the 3 products :

	A	B	C
<i>Direct materials :</i>			
Material X @ Rs. 6 per kg.	Rs. 12	Rs. 24	Rs. 18
Material Y @ Rs. 4 per kg.	8	—	4
<i>Direct labour :</i>			
Rs. 4 per hour	12	16	20
<i>Factory overheads :</i>			
Variable (@ Re. 1.00 per std. hr.	3	4	5
Fixed @ Rs. 2.00 per std. hr.	6	8	10

Variable overheads comprise indirect material, indirect labour and indirect expenses in the ratio of 50 : 25 : 25.

Fixed factory overheads stated above are based on the following Product Mix :

Product A	20,000 units
Product B	15,000 units
Product C	10,000 units

The mix of fixed factory overheads consists of indirect material, indirect labour and indirect expenses in the ratio of 30 : 30 : 40.

Price of Material X is expected to increase by Re. 0.20 per kg. in the budget period. There will be 2% inefficiency (i.e., 2% wastage allowance) in case of direct materials. A 3% increase in productivity of direct labour is expected. No other variances in direct costs are expected. These variances and any other variances in direct items have to be built into the budgets.

The selling and distribution cost budget for the two zones is as follows :

	Eastern	Western
<i>Zonal Manager's Control :</i>		
Commission	10% on Std. gross profit	10% on Std. gross profit
Travelling	Rs. 40,000	Rs. 35,000
Advertising	15,000	12,000
Office expenses	10,000	8,000
<i>Other Fixed Expenses :</i>		
Salaries	20,000	20,000
Perquisites	2,000	2,000
Depreciation	5,000	4,000
Insurance	1,000	1,000

The head office selling and distribution expenses are : Advertising and sales promotion Rs. 70,000 ; Salaries Rs. 42,000 ; Stationery, postage etc. Rs. 5,000 ; Depreciation Rs. 5,000 ; Insurance Rs. 1,000. Head Office Administration expenses are Rs. 2,00,000 and this should be met out of gross profit. The average rate of tax is 40%.

You are required to prepare the Budgeted Income Statement for the company.
(C.A. Final, Nov. 1981)

Working Notes

(a) Direct Materials :

Product		Material X		Material Y
A	$46,000 \times 2^*$	92,000	$46,000 \times 2$	92,000
B	$25,000 \times 4$	1,00,000	—	—
C	$10,000 \times 3$	30,000	$10,000 \times 1$	10,000
Total raw material required		2,22,000		1,02,000
Add : 2% wastage allowance		4,440		2,040
Gross raw material requirement		2,26,440		1,04,040
Rate per kg.	Rs.	6.20	Rs.	4.00
Total raw material cost		14,03,928		4,16,160

*Requirement of material per kg. of each product :

	Product A	Product B	Product C
	kg.	kg.	kg.
Material X (Std. cost ÷ rate per kg.)	2	4	3
Material Y (Std. cost ÷ rate per kg.)	2	—	1

(b) Direct Labour :

Labour requirement per kg. of each product

A	(Std. labour cost ÷ Rate per hour)	3 hrs.
B	"	4 hrs.
C	"	5 hrs.

Calculation showing direct labour cost

	Hrs.
Product A	$46,000 \times 3 = 1,38,000$
Product C	$25,000 \times 4 = 1,00,000$
Product B	$10,000 \times 5 = 50,000$
Total labour hours	2,88,000
Less : 3% saving in time due to increase in productivity	8,640
Hours to be paid for	2,79,360
Rate per hour	Rs. 4
Total direct labour cost	Rs. 11,17,440

(c) Variable Factory Overheads :

Requirement per kg. of standard hour	
Product	Std. Hours
A (Std. variable F.O. ÷ Rate per Std. Hr.)	3
B	4
C	5

Calculation showing the total variable Factory overhead

Product :	Std. Hours
A	46,000 × 3
B	25,000 × 4
C	10,000 × 5
	2,88,000 × Re. 1 = Rs. 2,88,000

It is to be split up into indirect material cost, indirect labour cost and indirect expenses in the ratio of 50 : 25 : 25.

Indirect material	Rs. 1,44,000
„ labour	72,000
„ expenses	72,000
	2,88,000

(d) Calculation of Fixed Factory Overhead

Products	Product mix units	I.O. Rate per unit	Total factory overhead
A	20,000	Rs. 6	Rs. 1,20,000
B	15,000	8	1,20,000
C	10,000	10	1,00,000
Total			3,40,000

This has to be split up into indirect material cost, indirect labour cost and indirect expenses in the ratio of 30 : 30 : 40 respectively.

Indirect material cost	Rs. 1,02,000
Indirect labour cost	1,02,000
Indirect expenses	1,36,000
	3,40,000

(e) Calculation of Commission on Sales

Sales budgets for Eastern and Western Zones are given. Total sales value for each product should be divided by units sold to arrive at the selling price per unit for each product. It should be noted that selling price of each product for both the zones is the same. Standard cost of each product is also given. With the given data, it is easy to find out the standard gross profit for each product :

Product	Eastern zone			Western zone		
	A	B	C	A	B	C
Selling price per unit	Rs. 50	Rs. 60	Rs. 80	Rs. 50	Rs. 60	Rs. 80
Less : Standard cost	41	52	57	41	52	57
(i) Std. gross profit per units	9	8	23	9	8	23
(i) No. of units in thousand	30	10	4	16	15	6
(iii) Total standard gross profit (Rs. '000)	270	80	92	144	120	138
Standard profit for both the zones	8,44,000					
Commission on sale (10% of profit)	Rs. 84,400					
	=====					

With the above adjusted figures of working, now it is easy to compute budgeted income statement.

Solution :- Budgeted Income Statement
for the period.....

Sales :

Product A	Rs. 23,00,000	Rs.
Product B	15,00,000	
Product C	8,00,000	46,00,000
	-----	-----

Less : Cost of production :

Direct material cost X	14,03,928	
Direct material cost Y	4,16,160	
[as at (a) in the Working notes]	-----	18,20,088
Direct labour cost		11,17,440
[as at (b) above]		

Variable Factory overheads :

[as at (c) above]		
Indirect material	1,44,000	
Indirect labour	72,000	
Indirect expenses	72,000	
	-----	2,88,000

Fixed factory overhead :

Indirect material	1,02,000	
Indirect labour	1,02,000	
Indirect expenses	1,36,000	3,40,000
	-----	-----

Total cost of production 35,65,528

Gross profit 10,34,472

Less : Head office expenses :

Administration	2,00,000	
Selling and distribution	1,23,000	
	<hr/>	3,23,000
Selling, distribution and other fixed expenses (as per total of both zones)	1,75,000	
Commission as per (c) above	84,400	
	<hr/>	2,59,400
Net profit		4,52,072
Less : Tax 40%		1,80,829
		<hr/>
Profit after tax		2,71,243
		<hr/> <hr/>

Budgeted Balance Sheet

***Problem 11'26.** The Twin Products Ltd. manufactures two products *A* and *B*. For preparing the Budget for the year ending 30th September 1988, the following data are relevant :

(i) Balance sheet as at 30-9-87

Share Capital	Rs. 4,00,000	Rs.
Retained Income	32,000	4,32,000
	<hr/>	<hr/>
Represented by :		
Plant and Machinery	4,00,000	
Less : Provision for Depreciation	1,00,000	
	<hr/>	3,00,000
Raw Materials	38,000	
Finished Goods	80,000	
	<hr/>	1,18,000
Debtors		30,000
Cash		20,000
		<hr/>
		4,68,000
Less :		
Creditors	16,000	
Provision for Taxation	20,000	
	<hr/>	36,000
		<hr/>
		4,32,000
		<hr/> <hr/>

(ii) The Sales Forecast gives a sales volume of 8,000 units of product *A* and 5,000 units of product *B* at an expected selling price per unit of Rs. 30 and Rs. 40 respectively.

(iii) The machining department and the finishing department are concerned with production. Materials *X* and *Y* are used in the manufacture of the products. The Direct Material and Direct Labour content in each unit of finished product are estimated as :

	<i>A</i>	<i>B</i>
Finished product (Content of each unit)		
Material X @ Rs. 3 per unit	2 units	4 units
Material Y @ Rs. 1 per unit	1 unit	2 units
Direct Labour : Machining Dept.	2 hours	1 hour
Finishing Dept.	1 hour	1 hour

Direct Labour Cost in the Finishing Dept. is Rs. 3 per labour hour for both *A* and *B*. Direct Labour Cost in the Machining Dept. is Re. 1 per labour hour for *A* and Rs. 2 per labour hour for *B*.

(iv) Factory overheads are applied on the basis of direct labour hours. At the expected output levels the following costs are forecasted :

	<i>Machining Dept.</i> <i>Rs.</i>	<i>Finishing Dept.</i> <i>Rs.</i>
Fixed Costs :		
Indirect labour	14,000	6,000
Repairs	4,000	1,000
Rates	12,000	2,000
Depreciation	16,000	4,000
Power	2,000	1,000
Variable cost per labour hour	0.50	1.50

Inventory Forecast :
Raw Materials :

	<i>X</i> <i>Units</i>	<i>Y</i> <i>Units</i>
Estimated closing stock	16,000	4,000
Opening stock	12,000	2,000
Finished Goods		

	<i>A</i> <i>Units</i>	<i>B</i> <i>Units</i>
Estimated closing stock	2,200	1,000
Opening stock	200	2,000

(v) The Selling, Distribution and Administration Expenses are forecasted at Rs. 60,300.

(vi) The cost of raw materials purchases, direct labour, factory overheads, selling, distribution and administration expenses will be met in full in cash. At 30th September 1988, it is estimated that the outstanding debtors and creditors will stand at Rs. 50,000 and Rs. 16,000 respectively. Tax owing at the beginning of the year will be paid during the year.

Profits are taxed at an average rate of 50%. Machinery purchases during the year estimated to cost Rs. 40,000 will be paid during the year.

You are required to prepare with all the necessary supporting schedules the following :

(a) The Cost of Goods Sold Budget

(b) The Cash Flow Budget for the year

(c) The Budgeted Balance Sheet as at 30th September, 1988, in the same format as given in the question.

(C A Final, Nov. 1988 Adopted; Nov. 1982;
ICWA (F), Dec. 1984 Adapted)

Solution. Before preparing the functional budgets and the master budget, following data/costs have to be computed first :

- (i) Production of products A and B
- (ii) Unit raw material cost for the two products and total raw materials costs.
- (iii) Productwise and total labour costs
- (iv) Total labour hours
- (v) Total factory overheads (including and excluding depreciation)
- (vi) Valuation of closing stock of finished goods
- (vii) Sales budget, collection from debtors, materials purchases, payment to creditors and retained income

Schedule 1. Production Budget

Product	A	B
Opening Stock + Production - Sales + Closing Stock		
Sales	8,000 units	5,000 units
Closing stock (Finished)	2,200	1,000
Total	10,200	6,000
Less : Opening stock (finished)	200	2,000
Production	10,000	4,000

Schedule 2. Total Direct Materials Cost Per unit

	A	B	Total
Material X @ Rs. 3 p.u.	Rs. 6	Rs. 12	
Material Y @ Rs. 1 p.u.	1	2	
1. Total Direct material cost per unit	7	14	
2. Production (units)	10,000	4,000	
3. Total direct material cost (1 × 2)	70,000	56,000	Rs. 1,26,000

Schedule 3. Total Direct Labour Cost

	<i>A</i>	<i>B</i>	
Machining Deptt. (Rs. 1 × 2)	Rs 2	Rs. 2	(Rs. 2 × 1)
Finishing Deptt. @ Rs. 3 per hr.	3	3	
	<hr/>	<hr/>	
1. Total labour cost per unit	5	5	
	<hr/>	<hr/>	
2. Production (units)	10,000	4,000	Total
3. Total direct labour cost (1 × 2)	50,000	20,000	Rs. 70,000

Schedule 4. Total Labour Hours

	<i>A</i>	<i>B</i>
Labour Hours—Machine	20,000	10,000
Finishing	4,000	4,000
	<hr/>	<hr/>
Total Labour Hours	24,000	14,000

Schedule 5

	<i>Total Factory Overheads</i>	
Departments	<i>Machining</i>	<i>Finishing</i>
1. Fixed costs	Rs. 48,000	Rs. 14,000
2. Labour Hours	24,000	14,000
	<hr/>	<hr/>
3. Fixed factory overhead per hour (1 ÷ 2)	Rs. 2.00	Rs. 1.00
4. Variable overheads	0.50	1.50
	<hr/>	<hr/>
5. Factory overhead rate per labour hour	2.50	2.50
	<hr/>	<hr/>
6. Total Labour Hours	24,000	14,000
	<hr/>	<hr/>
7. Total Factory overheads including depreciation (5 × 6)		
	Rs.	Rs.
Total	95,000	60,000
		Rs.
8. Total Factory overheads excluding depreciation		35,000
	= Rs. 95,000 – 20,000 = Rs. 75,000	

Schedule 6. Unit cost of Production and Valuation of Closing Stock.

	<i>A</i>	<i>B</i>	
Direct materials	Rs. 7.00	Rs. 14.00	
Direct labour	5.00	5.00	
Factory overheads :			
Machining (2 hrs × Rs. 2.50)	5.00	2.50	(2.50 × 1 hr)
Finishing (1 hr × Rs. 2.50)	2.50	2.50	(2.50 × 1 hr)
	<hr/>	<hr/>	
Total Factory cost	19.50	24.00	
	<hr/>	<hr/>	

Value of closing finished stockProduct A (2,200 units \times Rs. 19'50)=Rs. 42,900Product B (1000 units \times Rs. 24) 24,00066,900**Schedule 7. Sales Budget**Product A (8,000 \times 30) 2,40,000B (5,000 \times 40) 2,00,000Total sales 4,40,000**Schedule 8. Collection from Debtors**

Debtors at the beginning Rs. 30,000

Sales (schedule 7) 4,40,000

Total 4,70,000

Less : Debtors at the closing 50,000

Total collections from debtors 4,20,000**Schedule 9. Material Purchases**

		X	Y
		16,000 units	4,000 units
Closing stock			

Materials consumed	A	20,000	10,000
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	B	16,000	8,000
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Total		52,000	22,000
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Less : Opening stock		12,000	2,000
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1. Material purchased		40,000	20,000
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2. Purchase rate per unit		Rs. 3	Rs. 1
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3. Total purchases (1 \times 2)	Rs. 1,20,000	Rs. 20,000	
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Total Rs. 1,40,000

Schedule 10. Payment to Creditors

Creditors at the beginning Rs. 16,000

Purchases of materials (Sch. 9) 1,40,000

Total 1,56,000

Less : Creditors (closing) 16,000

Payment to creditors 1,40,000

Schedule 11. Statement showing the retained income

Sales (Schedule 7)	Rs. 4,40,000
<i>Less</i> : Cost of goods sold—statement (a)	3,04,100
	<hr/>
Gross profit	1,35,900
<i>Less</i> : Selling and Dist. and Admn. Exp.	60,300
	<hr/>
Profit before tax	75,600
<i>Less</i> : Provision for tax @ 50%	37,800
	<hr/>
Profit after tax	37,800
<i>Add</i> : Opening balance of retained income	32,000
	<hr/>
Total retained income	69,800
	<hr/>

Now the above computations are ready for preparation of cost of goods sold budget, cash flow budget, and budgeted balance sheet as at 30th September, 1988

THE TWIN PRODUCTS LTD.**(a) Cost of goods sold budget**

(Product A—8,000 units and product B—5,000 units)

Direct material (Schedule 2)	Rs. 1,26,000
Direct labour (Schedule 3)	70,000
Factory overheads (including Depreciation)	55,000
	<hr/>
Total cost of production	2,91,000
<i>Add</i> : Opening stock of finished goods	80,000
	<hr/>
	3,71,000
<i>Less</i> : Closing stock of finished goods (Sch. 6)	66,900
	<hr/>
Cost of goods sold	3,04,100
	<hr/>

(b) Cash flow budget for the year ending 30th Sept. 1988

	Rs.	
Opening balance of cash	20,000	
<i>Add</i> : Cash receipts (Sch. 8)	4,20,000	
	<hr/>	
Total		4,40,000
<i>Less</i> : Payment to creditors for purchases (Sch. 10)	1,40,000	
Direct wages	70,000	
Factory overheads (excl. Depn.)	75,000	
Selling, Dist. and Admn. Expenses	60,300	
	<hr/>	

(Cont d.)

Payment of taxes	20,000	
Machinery purchases	40,000	
	-----	4,05,300
Closing balance of cash		34,700

(c) Budgeted Balance Sheet as at 30th Sept. 1988		
Share capital	Rs. 4,00,000	
Retained income (Sch. 11)	69,800	
	-----	4,69,800

<i>Represented by :</i>		
Plant and Machinery	4,40,000	
Less : Provision for depreciation	1,20,000	
	-----	3,20,000
Raw materials	52,000	
Finished goods	66,900	
	-----	1,18,900
Debtors		50,000
Cash		34,700

Total		5,23,600
Less : Creditors	16,000	
Provision for taxation	37,800	
	-----	53,800

		4,69,800

RESPONSIBILITY ACCOUNTING

Problem 11'27. In a cotton textile mill, the spinning superintendent, weaving superintendent and the processing superintendent report to the Mill Manager who alongwith the Chief Engineer reports to Director (Technical). The sales manager alongwith publicity manager reports to Director (Marketing) who alongwith the Director (Technical) reports to the Managing Director. The following data have been extracted from the books for a particular period.

	Budget	Variances (A=Adverse, F=Favourable)
	Rs.	Rs.
Travelling expenses	40,000	2,000 A
Publicity Department Salaries and Administration	1,20,000	10,000 A
Sales Commission	2,50,000	10,000 F
Spinning Department Labour	8,00,000	40,000 A
Weaving Department Labour	6,00,000	20,000 A

Raw Materials	28,00,000	1,20,000 A
Process House Material	7,00,000	60,000 F
Maintenance Stores	2,00,000	10,000 F
Processing Department Labour	5,00,000	12,000 A
Maintenance Department Labour	2,60,000	5,000 F
Utilities—Spinning Department	1,50,000	15,000 A
—Weaving Department	2,00,000	10,000 F
—Processing Department	3,00,000	50,000 A
—Maintenance Department	50,000	10,000 A
Weaving Materials	1,00,000	5,000 A
Sales Department Salaries and Administration	1,00,000	5,000 F
Publicity expenses	2,00,000	2,000 F
Director (Technical) Office Salaries and Administration	1,75,000	25,000 A
Director (Marketing) Office Salaries and Administration	2,00,000	10,000 F
Managing Director's Office Salaries and Administration	2,50,000	20,000 A
Mill Manager's Salaries and Administration	1,00,000	5,000 A
Sales	1,00,00,000	12,00,000 A

Prepare responsibility accounting reports for the Managing Director, Director (Marketing), Director (Technical) and Mill Manager.

(I.C.W.A., Final December, 1985; CA Final Nov. 1983—Similar)

Solution. Responsibility Accounting Reports

1. For Mill Manager

	Budget Rs.	Actual Rs.	Variance Rs.
A. Spinning Superintendent :			
Raw Materials	28,00,000	29,20,000	1,20,000 (A)
Labour	8,00,000	8,40,000	40,000 (A)
Utilities	1,50,000	1,65,000	15,000 (A)
Total A	37,50,000	39,25,000	1,75,000 (A)
B. Weaving Superintendent :			
Materials	1,00,000	1,05,000	5,000 (A)
Labour	6,00,000	6,20,000	20,000 (A)
Utilities	2,00,000	1,90,000	10,000 (F)
Total B	9,00,000	9,15,000	15,000 (A)
C. Processing Superintendent			
Raw Materials	7,00,000	6,40,000	60,000 (F)
Labour	5,00,000	5,12,000	12,000 (A)

(Contd.)

BUDGETARY CONTROL

P11-73

Utilities	3,00,000	3,50,000	50,000 (A)
Total	15,00,000	15,02,000	2,000 (A)
<i>D. Mill Manager's Salaries and Admn.</i>	1,00,000	1,05,000	5,000 (A)
Total for Mill Manager (A+B+C+D)	62,50,000	64,47,000	1,97,000 (A)
2. For Chief Engineer			
Maintenance Stores	2,00,000	1,90,000	10,000 (F)
„ Labour	2,60,000	2,55,000	5,000 (F)
„ Utilities	50,000	60,000	10,000 (A)
Total for Chief Engineer	5,10,000	5,05,000	5,000 (F)
3. For Director Technical			
Mill Manager	62,50,000	64,47,000	1,97,000 (A)
Chief Engineer	5,10,000	5,05,000	5,000 (F)
Office Salary and Admn.	1,75,000	2,00,000	25,000 (A)
Total for Director (Technical)	69,35,000	71,52,000	2,17,000 (A)
4. For Director Marketing			
<i>A. Sales Manager</i>			
Income—Sales	1,00,00,000	88,00,000	12,00,000 (A)
Expenditure—Travelling	40,000	42,000	2,000 (A)
Sales Commission	2,50,000	2,40,000	10,000 (F)
Salary and Admn.	1,00,000	95,000	5,000 (F)
Total A	3,90,000	3,77,000	13,000 (F)
<i>B. Publicity Manager</i>			
Salary and Admn.	1,20,000	1,30,000	10,000 (A)
Publicity exp.	2,00,000	1,98,000	2,000 (F)
Total for B	3,20,000	3,28,000	8,000 (A)
<i>C. Director Marketing</i>			
Sales Manager (Income)	10,00,000	88,00,000	12,00,000 (A)
Sales Manager Exp.	3,90,000	3,77,000	13,000 (F)
Publicity Manager	3,20,000	3,28,000	8,000 (A)
Office Salary and Admn.	2,00,000	1,90,000	10,000 (F)
Total Exp.	9,10,000	8,95,000	15,000 (F)

5. For Managing Director

Mg. Dir.'s office staff	2,50,000	2,70,000	20,000 (A)
Director Marketing	9,10,000	8,95,000	15,000 (F)
Director Technical	69,35,000	71,52,000	2,17,000 (A)
	<u> </u>	<u> </u>	<u> </u>
Total Exp.	80,95,000	83,17,000	2,22,000 (A)
	<u> </u>	<u> </u>	<u> </u>
<i>Director-Marketing</i>			
Sales	1,00,00,000	88,00,000	12,00,000 (A)
	<u> </u>	<u> </u>	<u> </u>
Profit	19,05,000	4,83,000	14,22,000 (A)
	<u> </u>	<u> </u>	<u> </u>

Assignment of Labour Efficiency Variance According to Responsibility Centres

Problem 11'28. The net Labour Efficiency Variance for the Stamping Department of Workwell Manufacturers for the month of April 1985 was computed as follows :

Standard Labour Hours	28,500
Actual Labour Hours	30,200
	<u> </u>
Excess Hours	(1,700)
Standard wage rate per hour	Rs. 3'60
Unfavourable variance	6,120

The Factory Superintendent is responsible for all production operations. He asked the Stamping Department Foreman who reports to him to explain the reasons for the excess labour hours in the department. The foreman submitted the following analysis of excess labour hours for April :

Standard Hours in Production	28,500
Excess Hours :	
Trainee Operating Machine	48
Experienced Operator instructing Trainees	12
Rework time on items rejected by inspection	440
Rework time on Job 40 as instructions from Superintendent not clear	80
Raw Materials received from Stores too thick	75
Work done on stand—by obsolete machine, the regular one being over-loaded	600
Extra set—up time required after machine breakdown	15

(Contd.)

Idle time, no production schedule	420	
Unexplained	450	
	<hr/>	2,140
Less : Hours Saved		<hr/>
New Tools used	400	30,640
Asstt. Foreman assigned to machine operation for a week	440	
	<hr/>	440
		<hr/>
		30,200
		<hr/>

Examine each item carefully and group the items as falling within the responsibility of the Stamping Foreman, as falling within the responsibility of the Factory Superintendent and as items not coming under the purview of both. It is important that you assign proper reasons for taking an item under a particular group. (C.A. Final, May 1985)

Solution :**A. Items falling within the responsibility of stamping Foreman**

	Excess Hrs.	Reasons
1. Rework time on items rejected by inspection	440	Inefficiency in department.
2. Extra set-up time after machine breakdown	15	Result of proper preventing maintenance
3. Unexplained	450	Lack of proper time booking
	<hr/>	
	905	
	<hr/>	

Less : Asstt. Foreman assigned to machine operation for a week

	40
	<hr/>
Net excess hrs.	865
	<hr/>

B. Items falling within the responsibility of Factory Superintendent

	Excess Hrs.	Reasons
1. Rework on Job 40	80	Instructions not clear
2. Work done on stand-by obsolete machine	600	Proper scheduling was not done by factory superintendent

(Contd.)

3. Idle time	420	Lack of proper planning
	<u>1,100</u>	
Less : Hrs. saved due to new tools used	400	Due to innovation of factory superintendent
Net excess hrs.	<u>700</u>	

C. Items not coming under purview of both

	Excess Hrs.	Reasons
1. Trainee operating machine	48	Policy of management
2. Experienced operator instructing trainees	12	Policy of management
3. Raw materials received from stocks too thick	75	This activity is the responsibility of purchase deptt.
	<u>135</u>	
Total excess hrs.	<u>135</u>	
Grand Total (A+B+C)	<u><u><u>=1,700 Hrs.</u></u></u>	

Problem 11-29 (Responsibility Accounting). Plan for Profit Ltd. has the following Divisions : Marketing, Manufacturing, Materials Management, Despatch and Warehousing, Research and Engineering, Finance and Secretarial, Personnel and General Administration.

All the seven Divisional Heads after many meetings amongst themselves and due deliberation submit through the Managing Director, for the consideration of the Board of Directors, the Budget for the year 1988, indicating therein a pre-tax profit for the year of Rs. 225 lakhs.

The Directors are not satisfied with the figure of profit shown in the Budget. They feel that the profit can be improved upon by at least 25% and ask the Divisional Heads to have another look at the budget as the budget for 1988 has been prepared simply on the 1987 basis.

Meanwhile the Finance Manager finds that the profit figure shown in the budget has not taken into account the carry over effects of certain actions taken in 1987 :

—The effect of Salaries and Wages increase in total would be Rs. 5 lakhs, comprising Rs. 20,000 in each of the Marketing, Materials Management and Finance and Secretarial Divisions, Rs. 4 lakhs in Manufacturing Division, Rs. 30,000 in Research and Engineering and Rs. 10,000 in Personnel Division.

—Machine tools reconditioning programme undertaken already would increase the profit by Rs. 4 lakhs.

—Sale price increase effected would add Rs. 3 lakhs to profit.

—Net impact of other actions would result in a saving of Rs. 4.5 lakhs. Actions taken in Manufacturing, Engineering, Personnel and General Administration contributed to cost saving of Rs. 4.7 lakhs, Rs. 20,000 and Rs. 2.1 lakhs respectively, while correspondingly cost increases resulted in Marketing, Materials Management, Despatch and Warehousing to an extent of Rs. 30,000, Rs. 2 lakhs and Rs. 20,000 respectively.

Scanning the indications of environmental changes in 1988, the Marketing Manager envisages a market demand which would increase the sales by Rs. 33 lakhs, out of which, a third would be clean profit. On the other hand, Materials Manager envisages an inevitable rise in material cost of Rs. 8 lakhs.

Even when these are incorporated, as the profit comes nowhere near the target set by the Board, the Managing Director in concurrence with the Divisional Heads draws out a Management Plan of Action to improve the profit.

—An increase in Sale Price will result in a profit of Rs. 7 lakhs.

—... deeper market penetration to bring in an additional sale of Rs. 90 lakhs with a clean profit of a third.

— Reduction in material usage would save Rs. 5 lakhs.

—Improvement in manpower utilisation would bring in a saving of Rs. 5.5 lakhs.

—Expenditure towards additional Sales Promotion would be Rs. 1.5 lakhs and expenditure towards training in manufacturing division would be Rs. 2 lakhs and in marketing Rs. 50,000

—Other actions taken in the Divisions would net a saving of Rs. 7 lakhs—Machinery to a tune of Rs. 35 lakhs (cash outgo Rs. 25 lakhs) would be installed and this will effect a saving of Rs. 7 lakhs in manufacturing operations, Rs. 60,000 in Despatch and Warehousing and Rs. 20,000 in Engineering, while streamlining in Marketing, Finance and General Administration would increase the cost by Rs. 40,000, Rs. 20,000 and Rs. 20,000 respectively.

Keeping the pre-tax profit of Rs. 225 lakhs given in the Budget as the base, you are required to prepare :

(a) A simple statement for the Directors detailing the improvement on profit, itemwise, as aforesaid under the three heads—carry over effect of actions in 1987, Environmental changes in 1988, and changes resulting from Management Action Plan.

(b) A profit impact Summary by Divisional Accountability, itemwise, under the three heads, to enable each Divisional Head to know his contribution or otherwise, towards profit improvement, for which he is responsible.

(C.A. Final, November 1987)

(b) Profit impact summary by divisional accountability

	Divisions						Rs. in lakhs
	Total	Marketing	Manufacturing	Materials Management	Despatch and Warehousing	Research and Engineering	Finance and Personnel and General Secretarial Administration
I. Carry over effect							
(i) Salaries and wage	(5)	(0.2)	(4.0)	(0.2)		(0.3)	(0.1)
(ii) Machine tool reconditioning	4	3	4				
(iii) Sale Price increase	3						
(iv) Other actions	4.5	(0.3)	4.7	(2)	(0.2)	0.2	2.1
	6.5	2.5	4.7	(2.2)	(0.2)	(0.1)	2
II. Environmental changes							
(i) Market demand	11	11		(8)			
(ii) Rise in cost	(8)			(8)			
	3	11		(8)			
III. Management Action Plan							
(i) Sale Price	7	7					
(ii) Deeper Market Penetration (90÷3)	30	30					
(iii) Material Usage	5			5			
(iv) Man Power utilization	5.5						5.5
(v) Sales Promotion	(1.5)	(1.5)					
(vi) Training	(2.5)	(0.5)	(2.0)				
(vii) Other actions	7.0	(0.4)	7		0.6	0.2	(0.2)
	50.5	34.6	5.0	5.0	0.6	0.2	5.3
Total	60.0	48.1	9.7	(5.2)	0.4	0.1	7.3

Solution. A simple statement detailing the improvement on profit :
Rs. in lakhs

Pre-tax Profit		225.0
1. Carry over effects of action plan in 1987 :		
(i) Wages increase	(5)	
(ii) Machine tool reconditioning	4	
(iii) Sale price increase	3	
(iv) Other actions	4.5	6.5
	<hr/>	
2. Environmental changes in 1988 :		
(i) Market demand ($33 \div 3$)	11	
(ii) Rise in material cost	(8)	3.0
	<hr/>	
3. Management's action plan :		
(i) Increase in Selling Price	7	
(ii) Market Penetration ($90 \div 3$)	30	
(iii) Reduction in Material Cost	5	
(iv) Improvement in manpower utilization	5.5	
(v) Sales Promotion	(1.5)	
(vi) Training expenses	(2.5)	
(vii) Other actions—net	7	50.5
	<hr/>	
Revised Profit		285.0
		<hr/>

MISCELLANEOUS

Budgeted Income Statement and inter-transfer of labour force

Problem 11.31. ST Ltd. makes a product in three different flavours which require similar materials, labour and production facilities. The company's trading results for the year ending 31st December, 1986 are expected to be as shown below :

	Pineapple	Strawberry	Peppermint	Total
	Rs.	Rs.	Rs.	Rs.
Sales	5,36,000	4,30,000	2,60,000	12,26,000
Direct materials	1,34,000	1,29,000	1,04,000	3,67,000
Direct wages	1,07,200	64,500	84,000	2,55,700
Variable overhead	1,07,200	64,500	84,000	2,55,700
Total variable costs	3,48,400	2,58,000	2,72,000	8,78,400

Contribution	1,87,600	1,72,000	(12,000)	3,47,600
Fixed overhead				2,17,600
				<hr/>
Profit				1,30,000
				<hr/>

The peppermint flavour product has been causing management some concern and, because it is not possible to raise the selling price, it has decided, reluctantly, to cease production of this flavour. However, the production of the pineapple and strawberry flavours, for which there are willing buyers, is to be increased.

Management is unwilling to make anyone redundant and has decided to transfer 60% of the labour which was used on peppermint flavour to the production of pineapple—the remainder being transferred to strawberry. This change is proposed to be effective from 1st January, 1987.

Other relevant information for 1987 is as follows :

1. The total direct labour cost in 1987 is expected to be the same as that of 1986. (As part of the 'no redundancies' policy of management, the trade unions have agreed not to press for pay increases).
2. The unit variable cost structure and selling prices of pineapple and strawberry are to be the same in 1987 as in 1986.
3. Fixed overhead will increase by Rs. 13,800.

You are required to :

- (a) Prepare a budgeted statement for 1987 in a similar format to that shown above.
- (b) Comment on the statement you have prepared for (a) above.
- (c) Advise management whether a greater profit would be possible if the 60% of labour from the peppermint line were transferred to the strawberry line and 40% of labour to pineapple (*Note : there is no need to calculate the profit figure but your reason(s) for your conclusion must be stated*).

(C.I.M.A. London, Nov. 1986 Adapted; ICWA Final June 1989—Similar)

Solution.

Working :

	Pineapple		Strawberry	
	Rs.	%	Rs.	%
Sales	5,36,000	100	4,30,000	100%
D. Material	1,34,000	25	1,29,000	30
D. Wages	1,07,200	20	64,500	15
Variable O.H.	1,07,200	20	64,500	15
	<hr/>	<hr/>	<hr/>	<hr/>
Marginal Cost	3,48,400	65	2,58,000	60
	<hr/>	<hr/>	<hr/>	<hr/>
Contribution	1,87,600	35	1,72,000	40
	<hr/>	<hr/>	<hr/>	<hr/>

Direct Wages for 1987 :

As per 1986	1,07,200	64,500
60% of Rs. 84,000	50,400	
40% of Rs. 84,000		33,600
	-----	-----
(20% of sales)	1,57,600 (15% of Sales)	98,100
	-----	-----

On the basis of these figures, it is possible to calculate sales.

Material and variable overhead for 1987**(a) Budget Statement of 1987**

	<i>Products</i>				<i>Total</i>
	<i>Pineapple</i>		<i>Strawberry</i>		
	<i>Rs.</i>	<i>%</i>	<i>Rs.</i>	<i>%</i>	<i>Rs.</i>
Sales	7,88,000	100	6,54,000	100	14,42,000
	-----		-----		-----
Direct materials	1,97,000	25	1,96,200	30	3,93,200
Direct wages	1,57,600	20	98,100	15	2,55,700
Variable overhead	1,57,600	20	98,100	15	2,55,700
	-----		-----		-----
Marginal cost	5,12,200	65	3,92,400	60	9,04,600
	-----		-----		-----
Contribution	2,75,800	35	2,61,600	60	5,37,400
	-----		-----		-----
Less : Fixed Cost					
Rs. 2,17,600 + Rs. 13,800					2,31,400

Profit					3,06,000
					=====

(b) The transfer of production capacity from the peppermint lines to pineapple and strawberry lines is a welcome strategy. It will promote company's sales contribution and profit as follows :

	<i>1987</i>	<i>1986</i>	<i>Increase</i>	<i>%</i>
	<i>Rs.</i>	<i>Rs.</i>	<i>Rs.</i>	
Sales	14,42,000	12,26,000	2,16,000	18
Contribution	5,37,400	3,47,600	1,89,800	55
Profits	3,06,000	1,30,000	1,76,000	135

(c) Contribution per unit of key factor in the Pineapple line and Strawberry line is as follows :

$$\text{Strawberry line} = \frac{2,61,600}{98,100} \times 100 = 267\%.$$

$$\text{Pineapple line} = \frac{2,75,800}{1,57,600} \times 100 = 175\%.$$

If 60% of labour resources had been transferred to strawberry line and 40% to the pineapple line, profit would have increased.

Productwise and overall annual budgets

Problem 11'32. P.H. Ltd. manufactured and sold two products during 1981 as per particulars given below :

	<i>Product 'A'</i>	<i>Product 'B'</i>
Quantity (units)	6,00,000	3,00,000
	Rs./unit	Rs./unit
Selling price	6'00	10'00
Direct materials	1'00	2'00
Direct wages	1'20	2'60
Other overheads (50% variable)	1'00	0'60

Variable factory overheads are absorbed as a percentage of direct wages.

The summarised statement of profitability for 1981 is as under :

	Rs. lacs
Sales	66'00
Direct materials	12'00
Direct wages	15'00
Factory overheads	13'50
	(Of this Rs. 6'00 lacs is fixed)
Other overheads (50% fixed)	7'80

For the year 1982, due to fall in demand, the production and sales of Product 'A' will be reduced by 20% and of Product 'B' by 40%. It is, therefore, decided to introduce a new product 'C', the cost particulars for the same are as under :

Production and Sales	2,00,000 units
Selling price	Rs. 7'00 per unit
Direct materials	Rs. 1'40 per unit
Direct wages	2'40
Other variable overheads	Same as in Product 'A'

The fixed overheads will remain the same and the variable overheads will continue to be incurred at the same rate as in 1981.

You are required to :

- Prepare a productwise and overall budget for 1982.
- State what conclusions can be drawn from the budget for 1982 by using marginal costing technique.

(I.C.W.A., Final, Dec., 1981)

Solution. (i) Unit costs and prices of product A and product B are given. The summarised statement of profitability for 1981 for the company can be split into product-wise profitability. From this information, product-wise and overall budget for 1982 can be easily prepared by making the necessary adjustments as given in the question.

Statement showing the productwise and overall profitability for 1981

	<i>Product A</i>	<i>Product B</i>	<i>Total</i>
Sales (Quantity)	6,00,000	3,00,000	—
	Rs. Lakhs	Rs. Lakhs	Rs. Lakhs
(a) Sales	36'00	30'00	66'00
Direct Materials	6'00	6'00	12'00
Direct Wages	7'20	7'80	15'00
Variable Factory Overheads (50% of direct wages)	3'60	3'90	7'50
Variable Other Overheads	3'00	0'90	3'90
(b) Total variable costs	19'80	18'60	38'40
(c) Contribution costs (a—b)	16'20	11'40	27'60
P/V Ratio $\left(\frac{c}{a} \times 100\right)$	45%	38%	41'8%
<i>Less : Fixed cost</i>			
Factory overheads			6'00
Other overheads			3'90
Profit (contribution <i>minus</i> fixed-cost)			17'70

The profit for the year 1981 is Rs. 17'70 lakhs.

Statement showing the product-wise and overall budget for 1982

<i>Particulars</i>	<i>Products</i>			<i>Total</i>
	<i>A</i>	<i>B</i>	<i>C</i>	
Sales (Qty.)	4,80,000	1,60,000	2,00,000	—
	Rs. Lakhs	Rs. Lakhs	Rs. Lakhs	Rs. Lakhs
(a) Sales	28'80	18'00	14'00	60'80
Direct Material	4'80	3'60	2'80	11'20
Direct Wages	5'76	4'68	4'80	15'24
Variable Factory overheads	2'88	2'34	2'40	7'62
Variable other overheads	2'40	0'54	1'00	3'94
(b) Total variable overhead	15'84	11'16	11'00	38'00
Contribution (a—b)	12'96	6'84	3'00	22'80
P/V Ratio	45%	38%	21'4%	37'5%

Fixed cost :

Factory overheads	6'00
Other overheads	3'90
	<hr/>
Profit	12'90
	<hr/>

(ii) Conclusions :

- (a) During the year 1982 the profit has come down to Rs. 12'90 lakhs as against Rs. 17'70 lakhs during 1981.
- (b) The overall P/V Ratio has come down from 41'8% to 37'5%.
- (c) The break-even sales has gone up from Rs. 23'97 lakhs to Rs. 26'40 lakhs.
- (d) The margin of safety has been reduced from Rs. 42'33 lakhs (Rs. 63'00 lakhs *minus* Rs. 23'67 lakhs) to Rs. 34'40 lakhs (Rs. 60'80 lakhs *minus* Rs. 26'40 lakhs).

Effect of Reduced Budgeted Sales on Profitability

Problem 11'33. Gadgets Ltd. manufacturer's and sells one product only. The budgeted volume of production and sales is 70,000 units per month. The standard selling price is Rs. 4 per unit. The standard costs are as follows ;

Variable : Materials	Rs. 1.00
Labour	0'50
Fixed : Overheads	2.25
	<hr/>
Total	3'75
	<hr/>

The company carries a substantial stock of finished units at all times. The following statement has been prepared covering the first three month's trading of the current year :

	Month 1	Month 2	Month 3
Units produced	80,000	50,000	80,000
Units sold	80,000	70,000	60,000
Sales	Rs. 3,20,000	Rs. 2,80,000	Rs. 2,40,000
Standard cost of production	3,00,000	1,87,500	3,00,000
Stock transfer	—	75,000	(75,000)
Standard cost of sales	3,00,000	2,62,500	2,25,000
Standard Profit	20,000	17,500	15,000

In the opinion of the sales director, sales are likely to continue for the rest of the year at an average rate of 60,000 units per month. The managing director, although somewhat disappointed at this figure, says that the company is not likely to suffer with a monthly profit less than Rs. 15,000 and asks you to confirm his view.

You are required to write a brief memorandum to the managing director commenting on his view and setting out the position as you see it.
(I.C.W.A., Final, Dec., 1983)

Solution.

From :

To

Mr. X

The Managing Director,
Gadgets Ltd.,
New Delhi.

Management Accountant

Sub : Effect of reduced sales on profitability

Dear Sir,

This is in response to your request for my opinion on the likely effect of reduced sales level of 60,000 units on company's profits. Accordingly, I am submitting herewith a statement comparing the original monthly budget with the revised budget :

	Original monthly budget	Revised monthly budget
Sales (units)	70,000	60,000
1. Sales value	Rs. 2,80,000	Rs. 2,40,000
2. Less : Variable costs :		
Material	70,000	60,000
Labour	35,000	30,000
	1,05,000	90,000
3. Contribution(1-2)	1,75,000	1,50,000
4. Fixed overhead	1,57,500	1,57,500
5. Net profit (loss)	17,500	(7,500)

The above statement shows that due to fall in sales by 10,000 units, the profit gets reduced by Rs. 25,000 resulting in a net loss of Rs. 7,500. This is contrary to the original conclusion that the company would be able to maintain minimum profit of Rs. 15,000. The reason for this discrepancy is due to budgeted fixed overhead being originally apportioned over 70,000 units in order to arrive at a total unit cost. Inclusion of fixed overhead in determining unit cost unfortunately tend to distort profits, when the budgeted sales are not achieved. Therefore, the statement for the first three months has been revised to show the incidence of fixed overhead alongwith a year-end projection as follows :

	Month 1	Month 2	Month 3	Annual projections
Production (units)	80,000	50,000	80,000	7,50,000*
Sales (units)	80,000	70,000	60,000	7,50,000
Sales value @ Rs. 4 per unit	3,20,000	2,80,000	2,40,000	30,00,000
Standard variable cost (Rs. 1.50 per unit)	1,20,000	1,05,000	90,000	11,25,000
Contribution	2,00,000	1,75,000	1,50,000	18,75,000
Budgeted fixed overhead	1,57,500	1,57,500	1,57,500	18,90,000
Budgeted net profit (loss)	42,500	17,500	(7,500)	(15,000)
*Total of 3 months	=2,10,000 units			
For 9 months (60,000 × 9)	=5,40,000			
	7,50,000			

The revised monthly budget shows a net loss of Rs. 7,500 whereas as per annual projections, the net loss is Rs. 15,000. The B.E. sales (in units) is 63,000 (Fixed cost 1,57,500 ÷ contribution per unit Rs. 2.50). If there is reduction of 10% in sales volume of Rs. 70,000, then company will incur further loss. Therefore efforts should be made to reduce the fixed cost or reduce the variable cost. The management should concentrate on investigation of controllable variances. Every possible effort should be made to increase the unit selling price, alternative use of surplus capacity and finding additional markets for existing products. Pricing at marginal cost may be considered for export pricing purpose in the short run. You are therefore, advised to consider all the above factors before arriving at the final conclusions.

Revised Budget with Change in Variables

***Problem 11'34.** Electronics Ltd. furnishes you the following actual data of cost, price and output relating to four varieties of electronic calculators manufactured by them during the year 1981.

	Products			
	A	B	C	D
Output (units)	16,000	10,000	8,000	12,000
Per unit	Rs.	Rs.	Rs.	Rs.
Selling price	150	300	375	250
Direct Materials	30	70	80	30
Direct Wages	25	40	75	30
Variable overhead	50	80	150	60
Fixed overhead	50	80	150	60

In preparing the budget for the year 19×2, the company anticipated the following increases in costs and prices :

(a) The market will absorb an increase of 5% in the prices of each of the four products, if the volume of sales in quantities is maintained at the same level as in the year 19×1.

(b) The unit cost increases are expected to be :

(i) Direct Materials	5%
(ii) Direct Wages	10%
(iii) Variable Overheads	10%.

(c) The fixed overhead will go up by Rs. 80,000.

In order to combat inflation the Marketing Director puts forth the following proposals :

(a) *Product A.* The price of product A will be further increased by 10% (making in all a total increase of 15%) resulting thereby in a reduction in the volume of sales by 5%.

(b) *Product B.* Substitution of direct materials of product B by cheaper materials will bring about a reduction in direct material cost by Rs. 15/- per unit. This will reduce the sales volume in units by 5%.

(c) *Product C.* An allowance of special sales commission of 2% on the increased price on all quantities sold will increase the sales volume by 10%.

(d) *Product D.* A reduction in selling price by 5% on the price of 19×1 will yield an increase in sales volume by 15%.

The direct labour hour rate in 19×1 is Rs. 2'00 per hour and the number of direct labour hours cannot be increased in the year 19×2.

You are required to :

(i) Present a statement showing Profitability for the year 19×1.

(ii) Prepare a budget for the year 19×2 after taking into consideration the effects of inflation in costs and prices only.

(iii) Evaluate the proposals put forth by the Marketing Director and set an optimum product mix after taking into consideration the inflation in costs and prices but subject to the constraint of available labour hours.

(I.C.W.A. Final, June 1984 ; I.C.M.A. London May, 1983 Adapted)

Suggested Approach. In this question key factor is labour hours. Implementation of change reduces contribution per labour hour in case of products C and D and increases contribution per labour hour in case of A and B. Therefore, change should be implemented in A and B only.

Solution.

(i) **Statement showing profitability of 19X1**

	A	B	C	D	Total
Sales Units	16,000	10,000	8,000	12,000	
	Rs.	Rs.	Rs.	Rs.	Rs.
	in lakh	in lakh	in lakh	in lakh	in lakh
Sales	24'00	30'00	30'00	30'00	114'00
Direct Materials	4.80	7.00	6.40	3.60	21.80
Direct Wages	4.00	4.00	6.00	3.60	17.60

COUNTING

P11'86

COST A'

35.20

Production (units)
Sales (units)
Sales value @
Standard value
(Rs)

74.60

39.40

35.20

4.20

4.40

D

Total

12,000

Rs. lakh

Rs. lakh

Rs. lakh

31.50

119.70

3.72

3.78

22.89

6.60

3.96

19.36

Value

Overhead

13.20

7.92

38.72

18.2

26.52

15.66

80.97

Contribution
Fixed Overhead

6.96

10.55

4.98

15.84

38.73

Profit

36.00

2.73

Direct labour

hours

2,00,000

2,00,000

3,00,000

1,80,000

8,80,000

(Based on labour

hour rate in 19X1)

Contribution

3.48

5.48

1.66

8.80

per labour hour

(iii) Statement showing profitability position in 19X2, if the proposals of Marketing Director are accepted.

	A	B	C	D	Total
Sales Units	15,200	9,500	8,800	13,800	
Selling price per unit (Rs).	172.50	315.00	385.875**	237.50*	
	Rs. lakh	Rs. lakh	Rs. lakh	Rs. lakh	Rs. lakh
Sales Value	26.22	29.93	33.95	32.78	122.88

(Contd.)

$$** \frac{375 \times 105}{100} \times \frac{98}{100} = 385.875 \quad * \frac{250 \times 95}{100} = 237.50$$

BUDGETARY CONTROL

P11·89

Direct Material	4·79	5·56	7·39	4·35	22·09
Direct Wages	4·18	4·18	7·26	4·55	20·17
Variable Overheads	8·36	8·36	14·52	9·11	40·35
Total Variable Cost	17·33	18·10	29·17	18·01	82·61
Contribution	8·89	11·83	4·78	14·77	40·27
Fixed					36·00
Profit					4·27
Labour hours	1,90,000	1,90,000	3,30,000	2,07,000	9,17,000
Contribution per labour hour	4·67	6·23	1·45	7·13	

By implementing the change, contribution per labour hour reduces in case of Product C and Product D. Therefore, this change should be implemented in case of A and B only. The revised position on these lines will be as follows :

	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>Total</i>
Units	15,200	9,500	8,000	12,000	
Selling price/ unit (Rs.)	172·50	315	393·75	262·50	
	Rs. lakh	Rs. lakh	Rs. lakh	Rs. lakh	Rs. lakh
Sales	26·22	29·93	31·50	31·50	119·15
Direct Material	4·79	5·56	6·72	3·78	20·85
Direct Wages	4·18	4·18	6·60	3·96	18·92
Variable Overhead	8·36	8·36	13·20	7·92	37·84
Total Variable Overhead	17·33	18·10	26·52	15·66	77·61
Contribution	8·89	11·83	4·98	15·84	41·54
Fixed Overhead					36·00
					5·54
Direct labour hours	1,90,000	1,90,000	3,00,000	1,80,000	8,60,000
Contribution/L.H.	4·67	6·23	1·66	8·80	

Preparation of Total Cost Budget

Problem 11·35. Modern Manufacturers d., make an automobile component using a special kind of alloy steel as raw material. Each com-

ponent requires 3 lbs. of raw material costing Rs. 90 per lb. and 8 ounces of paint at Rs. 3.50 per ounce. It takes half an hour for fabrication and assembly and quarter of an hour to paint the unit. Fabrication and assembly labour is paid at Rs. 6 per hour while painters are paid Rs. 3.20 per hour. The variable overheads per component work out to Rs. 5.50 while the fixed overheads, assuming a normal annual production of 17,500 components, amount to Rs. 3,50,000.

The Material Management Manager is worried about the procurement of the special kind of alloy steel which is in scarce supply. Considering this aspect, the management envisages a maximum production of 15,000 components only for the next year.

(i) In the first instance, you are required to work out the total budget costs for the next year, based on the present working.

Even to make 15,000 components, the material management Manager feels that only two-thirds of the requirement of raw material could be produced locally, that too at a 10% price increase; for balance requirement, imports have to be made in form of semi-finished components at a cost of Rs. 380 per piece. As the components would have been painted, there would be no painting operations. Besides the fabrication and assembly time would be reduced by half and the variable overheads would be only Rs. 4 per component.

(ii) You are required to take note of this eventuality also and prepare the total budget costs for next year on this basis.

(I.C.W.A. Final, June, 1982)

Solution. (a) Budget : Production 15,000 components per annum

	Actuals for 17,500 units	Budget for 15,000 units
	Rs.	Rs.
Direct Material :		
Alloy steel		
3 lbs @ Rs. 90 = 270		
Paint 8 oz @ Rs. 3.50 = 28		
	298	44,70,000
Direct Labour :		
Fab. and Assem.		
½ hour @ Rs. 6 = Rs. 3.00		
Paint ¼ hour @ Rs. 3.20 = Rs. 0.80		
	Rs. 3.80	57,000
Variable Overheads	Rs. 5.50	82,500
Fixed Overheads	3,50,000	3,50,000
	57,27,750	49,59,500

- (b) Budget. 10,000 components on local material and
5,000 components on imports.

For 10,000 components :

Direct Material :

Alloy Steel 3 lb. @ Rs. 99 = 297

Paint 8 oz @ Rs. 3.50 = 28

325

32,50,000

Direct Labour :

Fab. and Assemb.

$\frac{1}{2}$ hour @ Rs. 6 = 3.00

Pains $\frac{1}{4}$ hour @ Rs. 3.20 = 0.80

3.80

38,000

Variable Overheads 5.50

55,000

Total cost per unit 334.30

33,43,000

For 5,000 components :

Direct material 380.00

19,00,000

Direct Labour :

Fab. and Assemb.

$\frac{1}{2}$ hour @ Rs. 6 1.50

7,500

Variable Overheads 4.00

20,000

Total Variable Cost

52,70,500

Fixed Cost

3,50,000

Total Budget Cost

56,20,500

Note. Management should consider, how surplus labour will be used, if components are imported. The long range effect of imports on production should also be taken care of.

Authors' Special Notes

(1) It is an important chapter both for Intermediate and Final levels.

(2) Note that in flexible budget preparation, main problem is segregating fixed and variable components of semi-variable overhead (Problems P 11'2, 11'3, 11'4, 11'5, 11'6, 11'8)

(3) For lengthy questions in functional budget preparation, follow the sequence in the questions asked at the end (Problem 11'10).

(4) Another point to be kept in view in functional budget preparation is the logical sequence in which functional budget preparation can

be thought of. For examples, Production Budget, then Material budget and Material cost budget etc. (Problems P11'14, 11'18, 11'19, 11'21, 11'22, 11'23, 11'24)

(5) Questions on Budgeted Income Statement are very important for C.A Final students (Problems 11'25, 11'31).

(6) Relate problem P 11 14 and Problem A 29 to note how basically same problem is asked in entirely different form.

(7) Do not let the language play the trick by improving your sensitivity to such parts of problems as :

Problem P 11'16—"Labour efficiency will be lower by another 1% and labour rates will be Rs. 22 per hour variable and fixed overhead will go up by 20% over 1980 actual"

P 11'20—"It has been suggested that 50% increase in budgeted advertising expenditure would double the portion of mail order sales and would permit a 50% reduction in budgeted travelling expenses"

P11'25—"There will be 2% inefficiency (*i.e.*, 2% wastage allowance) in case of direct materials. A 3% increase in productivity of direct labour is expected".

BREAK-UP OF THE PROBLEMS RELATING TO BUDGETARY CONTROL ACCORDING TO DIFFERENT LEVELS (FOR PROBLEMS WITH PREFIX A, REFER TO APPENDIX A)

Intermediate Level

Flexible Budget—P11'1, 11'3, 11'4, 11'5, 11'6, A44, A117, A169, A171

Functional Budgets P11'10, 11'12, 11'13, 11'15, A29, A140

Responsibility Accounting—P 11'29, 11'37,

Final Level

Flexible Budget—P 11'2, 11'7, 11'8, 11'9

Functional Budgets—P 11'11, 11'14, 11'16, 11'17, 11'18, 11'19, 11'20,
11'22, 11'23, 11'24, 11'36, A 1, A 85

Budgeted Income Statement—P 11'25, 11'26

Responsibility Accounting—P 11'27, 11'28, 11'29

Miscellaneous—P 11'31, 11'32, 11'33, 11'34, 11'35

Programme Budgeting—A 37

Please also refer to the Examples 12'1 to 12'14 of the book "Advanced Cost and Management Accounting—Text" by Saxena and Vashist.

Standard Costing—Variance Analysis

[Direct Material Variances 12·1—12·6, Direct Labour Variances 12·7—12·8, Overhead Variances 12·9—12·12, Sales Variance 12·13—12·15, Investigation of Variances 12·16—12·18, Miscellaneous 12·19—12·38]

DIRECT MATERIAL VARIANCES

Material Cost Variances

Problem 12·1 X Ltd. is producing floor covers in roll of standard size measuring 3 metres wide and 30 metres long by feeding raw materials to a continuous process machine. Standard mixture fixed for a batch of 900 sq. metres of floor cover is as follows :

- 2,000 kg of material A at Re. 1·00/kg
- 800 kg of material B at Re. 1·50/kg.
- 20 gallons of material C at Rs. 30/gallon.

During the period, 1505 standard size rolls were produced from material issued for 150 batches. The actual usage and the cost of materials were :

- 3,00,500 kg. of material A at Rs. 1·10/kg.
- 1,19,600 kg. of material B at Rs. 1·65/kg.
- 3,100 gallon of material C at Rs. 29·50/gallon.

Present the figures to management showing the break-up of material cost variances arising during the period. (I.C.W.A. Inter, Dec., 1984)

Solution.

M₁—Actual cost of material used

A—3,00,500 kg @ Rs. 1·10/kg	Rs. 3,30,550
B—1,19,600 kg @ Rs. 1·65/kg	1,97,340
C—3,100 gallon @ Rs. 29·50/gallon	91,450
	6,19,340

M₂—Standard cost of material used

Actual material used	Standard rate	Amount
A—3,00,500 kg	1.00	3,00,500
B—1,19,600 kg	1.50	1,79,400
C—3,100 gallon	30.00	93,000
		5,72,900

M_5 —Standard cost of material if it had been used in standard proportion. Standard mix has been given for one batch.

Standard mix for 150 batches will be :

A 2,000 kg \times 150 = 3,00,000 kg

B 800 kg \times 150 = 1,20,000 kg

C 20 gallon \times 150 = 3,000 gallons.

	Standard Mix	Standard Rate	Amount
A	3,00,000	\times 1.00	Rs. 3,00,000
B	1,20,000	\times 1.50	1,80,000
C	3,000	\times 30.00	90,000
			<hr/> 5,70,000 <hr/>

M_4 —Standard material cost of output

Size of one roll = 3 m \times 30 m = 90 sq. mt.

Output of one batch in sq. metres = 900

No. of rolls produced in one batch = 900/90 = 10 rolls.

Standard material cost of 10 rolls =

A	—	2,000 kg \times 1.00 =	Rs. 2,000
B	—	800 kg \times 1.50 =	1,200
C	—	20 gln. \times 30.00 =	600
			<hr/> 3,800 <hr/>

Standard material of 1505 rolls = $\frac{3,800}{10} \times 1505$ = Rs. 5,71,900.

Variances

1. Material price variance = $M_1 - M_2$ or Rs. 46,440 (A)
2. Material mix variance = $M_3 - M_5$ or Rs. 2,900 (A)
3. Material yield variance = $M_3 - M_4$ or Rs. 1,900 (F)
4. Material usage variance = $M_2 - M_4$ or Rs. 1,000 (A).

Alternatively it is equal to :

Material mix variance + Material yield variance

= Rs. 2,900 (A) + Rs. 1,900 (F) or Rs. 1,000 (A)

5. Material cost variance = $M_1 - M_4$ or Rs. 47,440 (A)

Alternatively = Material price variance + Material usage variance

= Rs. 46,440 (A) + Rs. 1,000 (A) or Rs. 47,440 (A).

Problem 12.2. S.V. Ltd., manufactures BXE by mixing three raw materials. For every batch of 100 kgs. of BXE, 125 kgs. of raw materials are used. In April 1983, 60 batches were prepared to produce an output of 5,600 kgs. of BXE. The standard and actual particulars for April 1983 are as follows :

Raw Material	Standard		Actual		Quantity of Raw Materials Purchased
	Mix	Price per Kg	Mix	Price per Kg	
	%	Rs.	%	Rs.	
A	50	20	60	21	5,000
B	30	10	20	8	2,000
C	20	5	20	6	1,200

Calculate all variances.

(16 marks)

(C.A. Inter, May 1983)

Solution.

Actual Material used = 125 kg × 60 = 7,500 kg.

M₁—Actual cost of actual material used

A	60% 4,500 kg × Rs. 21	=Rs. 94,500
B	20% 1,500 kg × Rs. 8	=Rs. 12,000
C	20% 1,500 kg × Rs. 6	=Rs. 9,000
	<u>7,500</u>	<u>1,15,500</u>

M₂—Standard cost of material used

A	4,500 kg × Rs. 20	=Rs. 90,000
B	1,500 kg × Rs. 10	=Rs. 15,000
C	1,500 kg × Rs. 5	=Rs. 7,500
	<u>7,500 kg</u>	<u>1,12,500</u>

M₃—Std. cost of material, if it had been used in standard proportion.

A	3,750 kg × Rs. 20	=Rs. 75,000
B	2,250 kg × Rs. 10	=Rs. 22,500
C	1,500 kg × Rs. 5	=Rs. 7,500
	<u>7,500 kg</u>	<u>1,05,000</u>

M₄—Standard cost of production

Std. cost of output for 100 kg :

A	62.50 kg × Rs. 20	=Rs. 1,250
B	37.50 kg × Rs. 10	=Rs. 375
C	25.00 kg × Rs. 5	=Rs. 125
	<u>125.00</u>	<u>1,750</u>

Std. cost for output of 5,600 kg

$$= \frac{1,750}{100} \text{ kg} \times 5,600 \text{ kg}$$

$$= \text{Rs. } 98,000.$$

$$\text{Material Price Variance} = M_1 - M_3 = \text{Rs. } 1,15,500 - \text{Rs. } 1,12,500 \\ \text{Rs. } 3,000 \text{ (A)}$$

$$\text{Material Mix. Variance} = M_2 - M_3 = \text{Rs. } 1,12,500 - \text{Rs. } 1,05,000 \\ = \text{Rs. } 7,500 \text{ (A)}$$

$$\text{Material Yield Variance} = M_3 - M_4 = \text{Rs. } 1,05,000 - \text{Rs. } 98,000 \\ = \text{Rs. } 7,000 \text{ (A)}$$

$$\text{Material usage Variance} = M_3 - M_4 = \text{Rs. } 1,12,500 - \text{Rs. } 98,000 \\ = \text{Rs. } 14,500 \text{ (A)}$$

Note. Material Price Variance can be calculated at the time of purchases as well. In that case, material price variance will be as follows :
 M_1 —Actual cost of material used :

A	5,000 kg × Rs. 21	=Rs. 1,05,000
B	2,000 kg × Rs. 8	=Rs. 16,000
C	1,200 kg × Rs. 6	=Rs. 7,200
		<hr/>
		1,28,200
		<hr/>

M_2 —Standard cost of material used :

A	5,000 kg × Rs. 20	=Rs. 1,00,000
B	2,000 kg × Rs. 10	=Rs. 20,000
C	1,200 kg × Rs. 5	=Rs. 6,000
		<hr/>
		1,26,000
		<hr/>

$$\text{Material Price Variance (if calculated at the time of purchase)} \\ = M_1 - M_2 = \text{Rs. } 1,28,200 - \text{Rs. } 1,26,000 \\ = \text{Rs. } 2,200 \text{ (A).}$$

Problem 12.3. Mixers Ltd., is engaged in producing a 'standard mix' using 60 kgs of chemical X and 40 kgs of chemical Y. The standard loss of production is 30%. The standard price of X is Rs. 5 per kg and of Y is Rs. 10 per Kg.

The actual mixture and yield were as follows :

X 80 kgs @ Rs. 4.50 per kg and

Y 70 kgs @ Rs. 8.00 per kg

Actual yield 115 Kgs.

Calculate Material Variances (price, usage, yield, mix).

(C.S. Final—December, 1982)

Solution.

M_1 —Actual cost of material used :

X	80 kg × Rs. 4.50	=Rs. 360
Y	70 kg × Rs. 8.00	=Rs. 560
		<hr/>
		920
		<hr/>

M_2 —Actual Material used at standard price :

X—80 kg × Rs. 5.00	=Rs. 400
Y—70 kg × Rs. 10.00	=Rs. 700
	<hr/>
	1,100
	<hr/>

M_3 —Cost of material if it had been used in standard mix. at standard price :

X 90 kg × Rs. 5.00	=Rs. 450
Y 60 kg × Rs. 10.00	=Rs. 600
	<hr/>
150	1,050
	<hr/>

M_4 —Standard material cost of production .

X 60 kg × Rs. 5.00	=Rs. 300
Y 40 kg × Rs. 10.00	=Rs. 400
	<hr/>
100 kg	700
	<hr/>

Loss 30 kg

Output 70 kg

$$\therefore \frac{\text{Rs. } 700}{70 \text{ kg}} \times 115 \text{ kg} = \text{Rs. } 1,150$$

$$\text{Material Price Variance} = M_1 - M_2 = \text{Rs. } 920 - \text{Rs. } 1,100 = 180 (F)$$

$$\text{Material Mix. Variance} = M_2 - M_3 = \text{Rs. } 1,100 - \text{Rs. } 1,050 = 50 (A)$$

$$\text{Material Yield Variance} = M_3 - M_4 = \text{Rs. } 1,050 - \text{Rs. } 1,150 = 100 (F)$$

$$\text{Material Usage Variance} = M_2 - M_4 = \text{Rs. } 1,100 - \text{Rs. } 1,150 = \text{Rs. } 50 (F)$$

$$\text{Material Cost Variance} = M_1 - M_4 = \text{Rs. } 920 - \text{Rs. } 1,150 = 230 (F).$$

Problem 12.4 (Missing Values). One kilogram of product 'K' requires two chemicals A and B. The following were the details of product 'K' for the month of June 1987 :

- Standard mix Chemical 'A' 50% and Chemical 'B' 50%.
- Standard price per kilogram of Chemical 'A' Rs. 12 and Chemical 'B' Rs. 15.
- Actual input of Chemical 'B' 70 kilograms.
- Actual price per kilogram of Chemical 'A' Rs. 15.
- Standard normal loss 10% of total input.
- Materials cost variance total Rs. 650 adverse.

(g) Materials yield variance total Rs. 135 adverse.

You are required to calculate :

- (1) Materials mix variance total
- (2) Materials usage variance total
- (3) Materials price variance total
- (4) Actual loss of actual input
- (5) Actual input of Chemical 'A'
- (6) Actual price per kilogram of Chemical 'B'.

Solution.

(C.A. Inter, November 1987)

It is assumed that actual output is 90 kg and all the variance given relate to this actual output. If this assumption is changed, the answer will also change.

1. Cost of output as per standard :

	Qty (kg.)	Price (Rs.)	Amount (Rs.)
Chemical A	50	12	600
Chemical B	50	15	750
	<hr/> 100		<hr/> 1,350
Standard loss	<hr/> 10		
	<hr/> 90		

∴ Standard rate of output per kg. = Rs. $1,350 \div 90$ kg.
= Rs. 15 per kg.

Since it is assumed that actual output is 90 kg.

M_4 —Standard cost of production = Rs. 1,350

2 It is given that yield variance is Rs. 135 (A).

∴ M_3 —Cost of material, if it had been used in standard proportion
= Rs. 1,350 + Rs. 135 = Rs. 1,485

Standard weight of material used for this yield of 90 kg.

= 90 kg. + (Rs. $135 \div$ Rs. 15 per kg., i.e., rate of standard output)
= 99 kg.

For standard output of 90 kg. actual weight used should be 100 kg.

For standard output equivalent to 99 kg., actual weight used should be $100 \text{ kg} \div 90 \text{ kg} \times 99 \text{ kg} = 110 \text{ kg}$.

∴ Actual weight used for M_3 = 110 kg.

3. Material cost variance (Given) = 650 (A)

∴ M_1 —Actual cost of material used = Rs. 1,350 + Rs. 650
= Rs. 2,000

It is given that actual weight of chemical B = 70 kg.

∴ Actual weight of chemical A = 110 kg. — 70 kg. = 40 kg.

M_1 —Actual cost of material used

Chemical A 40 kg. \times Rs. 15	= Rs. 600
„ B 70 kg. \times (says	= 1,400
	<hr/>
Value of M_1 has already been found out as	2,000
	<hr/>

\therefore x or Actual Price per kg. of chemical B = Rs. $1,400 \div 70$ kg.
= Rs. 20 per kg.

4. M_2 —Standard cost of material used

Chemical A 40 kg. \times Rs. 12	= Rs. 480
Chemical B 70 kg. \times Rs. 15	= Rs. 1,050
	<hr/>
	1,530
	<hr/>

\therefore Price Variance = $M_1 - M_2$ = Rs. 2,000 — Rs. 1,530 = Rs. 470 (A).

5. M_3 —Standard cost of material, if it had been used in standard proportion

Chemical A 55 kg. \times Rs. 12	= Rs. 660
Chemical B 55 kg. \times Rs. 15	= Rs. 825
	<hr/>

(This is in line with working note at serial No. 2) 1,485

\therefore Mix Variance = $M_2 - M_3$ = Rs. 1,530 — Rs. 1,485 = Rs. 45 (A)

6. Usage Variance = $M_2 - M_4$ = Rs. 1,530 — Rs. 1,350 = Rs. 180 (A)

Alternatively, Mix Variance + Material yield variance

= Rs. 45 (A) + Rs. 135 (A) = Rs. 180 (A)

\therefore Required values are :

- (1) Material mix variance = Rs. 45 (A) (Refer to serial No. 5)
- (2) Material usage variance = Rs. 180 (A) (Refer to serial No. 6)
- (3) Material price variance = Rs. 470 (A) (Refer to serial No. 4)
- (4) Actual loss of input = 110 kg. — 90 kg. = 20 kg.
- (5) Actual input of chemical A = 40 kg. (Refer to serial No. 3)
- (6) Actual price per kilogramme of chemical B = Rs. 20
(Refer to serial No. 3)

Calculation of Material Variances and Reconciliation of Standard Cost with Actual Cost

Problem 12.5. The standard cost of a chemical mixture 'PQ' is as follows :

40% of material P @ Rs. 400 per kg.

60% of material Q @ Rs. 600 per kg.

A standard loss of 10% is normally anticipated in production. The following particulars are available for the month of September 1984 :

180 kg. of material P has been used @ Rs. 360 per kg.

220 kg. of material Q has been used @ Rs. 680 per kg.

The actual production of 'PQ' was 369 kg.

Calculate the following variances :

(a) Material price variance (b) Material usage variance

(c) Material mix variance (d) Material yield variance.

Also show the reconciliation of Standard Cost with Actual Cost with the help of above variances. (I.C.W.A. Inter, Dec. 1984)

Solution. M_1 —Actual cost of material used

P—180 kg. \times Rs. 360 = Rs. 64,800

Q—220 kg. \times Rs. 680 = 1,49,600

— — — —	— — — —
400 kg	2,14,400
— — — —	— — — —

M_2 —Standard cost of material used

P—180 kg. \times Rs. 400 = Rs. 72,000

Q—220 kg. \times Rs. 600 = 1,32,000

— — — —	— — — —
400 kg.	2,04,000
— — — —	— — — —

M_3 —Standard cost of material, if it had been used in standard proportion

P—40% \times 400 kg. \times Rs. 400 = Rs. 64,000

Q—60% \times 400 kg. \times Rs. 600 = 1,44,000

— — — —
2,08,000
— — — —

M_4 —Standard material cost of production:

Suppose the input is 100 kg.

	S.Q.	S.P	Rs.
P	40 kg. \times	Rs. 400	= 16,000
Q	60 kg. \times	Rs. 600	= 36,000
	100 kg.		
Std. loss (10%)	10		
Output	90 kg		52,000

Standard material cost of actual production 369 kg.

$$= 52,000 \div 90 \times 369 = \text{Rs. } 2,13,200.$$

Variance

$$\text{Material Price Variance} = M_1 - M_2 = \text{Rs. } 2,14,400 - 2,04,000 \\ \text{or Rs. } 10,400 \text{ (A)}$$

$$\text{Material mix variance} = M_2 - M_3 = \text{Rs. } 2,04,000 - 2,08,000 \\ \text{or Rs. } 4,000 \text{ (F)}$$

$$\text{Material yield variance} = M_3 - M_4 = \text{Rs. } 2,08,000 - 2,13,200 \\ \text{or Rs. } 5,200 \text{ (F)}$$

$$\text{Material usage variance} = M_3 - M_4 = \text{Rs. } 2,04,000 - 2,13,200 \\ \text{or Rs. } 9,200 \text{ (F)}$$

Alternatively Material usage variance

$$= \text{Material mix variance} + \text{Material yield variance}$$

$$= \text{Rs. } 4,000 \text{ (F)} + \text{Rs. } 5,200 \text{ (F)} \text{ or Rs. } 9,200 \text{ (F)}$$

$$\text{Material cost variance} = M_1 - M_4$$

$$= \text{Rs. } 2,14,400 - 2,13,200 \text{ or Rs. } 1,200 \text{ (A)}$$

Alternatively it is equal to Material price variance + Material usage variance

$$= \text{Rs. } 10,400 \text{ (A)} + \text{Rs. } 9,200 \text{ (F)} \text{ or Rs. } 1,200 \text{ (A)}.$$

Problem 12.6. From the following data for May, 1981 of a factory, calculate :

- (a) Material cost variance. (b) Material price variance
(c) Material usage variance. (d) Material mix variance.
(e) Material yield variance.

Name of material	Standard		Actual	
	kg.	Rate	kg.	Rate
X	8,000	Rs. 1.05	7,500	Rs. 1.20
Y	3,000	2.15	3,300	2.30
Z	2,000	3.30	2,400	3.50

(ICWA., Inter, June, 1981)

Solution.

For Material Cost Variances

M_1 — Actual Cost of material used

Material	Kgs.		Actual rate		Amount
			Rs.		Rs.
X	7,500	×	1.20	=	9,000
Y	3,300	×	2.30	=	7,590
Z	2,400	×	3.50	=	8,400
					<hr/>
	13,200				24,990
					<hr/>

M₂—Standard cost of material used

Material	Kg.		Standard rate		Amount
			Rs.		Rs.
X	7,500	×	1·05	=	7,875
Y	3,300	×	2·15	=	7,095
Z	2,400	×	3·30	=	7,920
	<u>13,200</u>				<u>22,890</u>

M₃—Standard cost of material, if it had been used in standard proportion

Material	Details	Kg.		Standard rate		Amount
				Rs.		Rs.
X	13,200 (8,000 ÷ 13,000) or	8,123	×	1·05	=	8,529
Y	13,200 (3,000 ÷ 13,000) or	3,046	×	2·15	=	6,549
Z	13,200 (2,000 ÷ 13,000) or	2,031	×	3·30	=	6,702
						<u>21,780</u>

M₄—Standard material cost of output.

Material	Standard quantity		Standard rate		Amount
	kg.		Rs.		Rs.
X	8,000	×	1·05	=	8,400
Y	3,000	×	2·15	=	6,450
Z	2,000	×	3·30	=	6,600
					<u>21,450</u>

Variances**(b) Material Price Variance**

$$M_1 - M_2 = \text{Rs. } 24,990 - \text{Rs. } 22,890 \text{ or Rs. } 2,100 \text{ (A)}$$

(d) Material Mix Variance

$$M_2 - M_3 = \text{Rs. } 22,890 - \text{Rs. } 21,780 \text{ or Rs. } 1,110 \text{ (A)}$$

(e) Material Yield Variance

$$M_3 - M_4 = \text{Rs. } 21,780 - \text{Rs. } 21,450 \text{ or Rs. } 330 \text{ (A)}$$

(a) Material Cost Variance

$$M_1 - M_4 = \text{Rs. } 24,990 - \text{Rs. } 21,450 \text{ or Rs. } 3,540 \text{ (A)}$$

Alternatively,

$$= \text{Material Price Variance} + \text{Material Mix Variance} \\ + \text{Material Yield Variance}$$

$$= \text{Rs. } 2,100 \text{ (A)} + \text{Rs. } 1,110 \text{ (A)} + \text{Rs. } 330 \text{ (A)} = \text{Rs. } 3,540 \text{ (A)}$$

(c) Material Usage Variance

$$M_2 - M_4 = \text{Rs. } 22,890 - \text{Rs. } 21,450 \text{ or Rs. } 1,440 \text{ (A)}$$

Alternatively,

= Material Mix Variance + Material Yield Variance

= Rs. 1,110 (A) + Rs. 330 (A) or Rs. 1,440 (A)

DIRECT LABOUR VARIANCES

Labour Cost Variances and Averages Labour Cost

Problem 12.7. The direct labour strength of a section of an Engineering factory is 100 workers paid at the rate of Rs. 6 00 per day of 8 hours each. The normal production is 1,000 pieces per week of 48 hours. During a particular week an order for 1,500 pieces was completed expending in all 7,650 hours made up 6,300 hours at normal wages and 1,350 hours at overtime wages at double rate. The total wages came to Rs. 6,300. Calculate the average labour cost per piece during the week and analyse the labour cost variance for the week.

(I.C.W.A., Inter, Dec., 1982 & June, 1986)

Solution. (For detailed discussion on Labour Cost Variances, please refer to 'Cost and Management Accounting—Text' by Saxena and Vashist).

For direct wage variance

L_1 —Actual payment made to workers for actual hours worked
= Rs. 6,300 (Given)

L_2 —Payment involved, if work had been paid at standard rate
Actual hrs, 7,650 \times Standard rate Rs. 0.75 = Rs. 5,737.50.

L_3 —Not applicable, as there is no labour gang variance.

L_4 —Not applicable, as there is no idle time variance.

L_5 —Standard labour cost of output achieved

= Standard labour cost per unit \times Actual production

= $\frac{\text{Total wages for week as per standard}}{\text{Production in units}} \times \text{Actual production}$

= $\{(6 \div 8) \times 48 \times 100\} \times 1,500 = \text{Rs. } 5,400.$

Variances :

Wage rate variance : $L_1 - L_2$
= Rs. 6,300 — Rs. 5,737.50 or Rs. 562.50 (A)

Wage efficiency variance : $L_2 - L_5$
= Rs. 5,737.50 — Rs. 5,400 or Rs. 337.50 (A)

Wage cost variance : $L_1 - L_5$
= Rs. 6,300 — Rs. 5,400 or Rs. 900 (A)

Alternatively,

= Wage rate variance + Wage efficiency variance

= Rs. 562.5 (A) + Rs. 337.5 (A) or Rs. 900 (A)

Average cost per piece :

1. Actual hours worked in the week = 7,650

2. Pieces completed = 1,500

Skilled	9,000 hrs × Rs. 3.00 = Rs. 27,000
Semi-skilled	8,400 hrs × Rs. 1.50 = 12,600
Unskilled	20,000 hrs × Rs. 1.00 = 20,000
	<hr/>
	37,400 hrs. Rs. 59,600

L_3 —Payment involved, if workers had been used in the ratio of standard gang.

Skilled	37,400 hrs × (10/34) × Rs. 3.00 = Rs. 33,000
Semi-skilled	37,400 hrs × (8/34) × Rs. 1.50 = 13,200
Unskilled	37,400 hrs × (16/34) × Rs. 1.00 = 17,600
	<hr/>
	Rs. 63,800

L_1 —Nil (there is no idle time variance)

L_4 —Standard labour cost of output

1000 articles × Rs. 58 (given) = Rs. 58,000

Labour Rate Variance = $L_1 - L_2$ = Rs. 66,600 - 59,600 = Rs. 7,000 (F)

Labour Gang Variance = $L_2 - L_3$ = Rs. 59,600 - 63,800 = Rs. 4,200 (A)

Labour Yield Variance = $L_3 - L_4$ = Rs. 63,800 - 58,000 = Rs. 5,800 (A)

Labour Cost Variance = $L_1 - L_5$ = Rs. 66,600 - 58,000 = Rs. 8,600 (A)

Labour Efficiency Variance = $L_2 - L_5$ = Rs. 59,600 - 58,000 = Rs. 1,600 (A)

OVERHEAD VARIANCES

Variable and fixed overhead variances

Problem 12.9. From the following prepare variance analysis of a particular department for a month :

<i>Variable overhead items</i>	<i>Actual (Rs.)</i>
Materials handling	8,325
Idle time	850
Rework	825
Overtime premium	250
Supplies	4,000
	<hr/>
	14,250
	<hr/>
<i>Fixed overhead items</i>	
Supervision	1,700
Depreciation Plant	2,000
Depreciation Equipment	5,000
Rates	1,150
Insurance	350
	<hr/>
	10,200
	<hr/>

Normal capacity 10,000 standard hours, budgeted rate Rs. 1.70 per standard hour for variable overhead and Re. 1.00 per standard hour for fixed overhead. Actual level : 8,000 standard hours.

(I.C.W.A. Inter, June 1987)

Solution. For Variable Overhead Variances

VO ₁ —Actual variable overhead	=Rs. 14,250
VO ₂ —Actual hours worked at std. V.O. rate 8,000 hrs × Rs. 1.70	= 13,600
V.O. Expenditure Variance VO ₁ —VO ₂	= 650 (A)

For Fixed Overhead Variances

FO ₁ —Actual F.O. incurred	=Rs. 10,200
FO ₂ —Budgeted F.O. (10,000 hrs × Re. 1)	= 10,000
FO ₃ —Not applicable	
FO ₄ —Fixed overheads for actual hours worked at std. rate (8,000 hrs. × Re. 1)	= 8,000
FO ₅ —Not applicable	
F.O. Expenditure Variance FO ₁ —FO ₂ —Rs. 10,200—10,000	= or 200 (A)
F.O. Capacity Variance FO ₂ —FO ₄ —Rs. 10,000—8,000	= or 2,000 (A)
F.O. Variance=F.O. Expenditure Variance + F.O. Capacity Variance	= 2,200 (A)

Problem 12 10.

Items	Budget	Actual
No. of working days	20	22
Manhours per day	8,000	8,400
Output per manhours in units	1.0	.9
Overhead cost (Rs.)	1,60,000	1,68,000

Calculate overhead variances

(C.S. Final June, 1979 ; C.A. Final May, 83 ; C.A. Inter, Nov. 1981 Modified)

Solution.

FO ₁ —Actual O.H. incurred	=Rs. 1,68,000
FO ₂ —Budgeted F.O.H.	=Rs. 1,60,000
FO ₃ —Fixed overhead for days/hours available at F.O.H. rate = 22 days × 8,400 hrs × Re. 1.00 =Rs. 1,84,800	
FO ₄ —not applicable—All available hrs. were used	=Nil
FO ₅ —Standard Fixed OH for production Actual production × Std. F.O.H. rate	

$$\left\{ 22 \times 8,400 \times 0.9 \right\} \times \left\{ \frac{\text{Rs. } 1,60,000}{1,60,000 \text{ unit}} \right\} = \text{Rs. } 1,66,320$$

{i.e., production}

Fixed O.H. Expenditure Variance = FO₁—FO₂ or Rs. 1,68,000—1,60,000
= Rs. 8,000 (A)

$$\text{Fixed Overhead Calendar or Idle Time Variance} = FO_4 - FO_3$$

$$\text{Rs. } 1,60,000 - 1,84,800 \quad \text{or Rs. } 24,800 \text{ (F)}$$

$$\text{Fixed O.H. Efficiency Variance} = FO_3 - FO_5 = \text{Rs. } 1,84,800 - 1,66,320$$

$$\text{or Rs. } 18,480 \text{ (A)}$$

$$\text{Fixed O.H. Volume Variance} = FO_3 - FO_5$$

$$= \text{Rs. } 1,60,000 - \text{Rs. } 1,66,320 = \text{Rs. } 6,320 \text{ (F)}$$

$$\text{Fixed O.H. Variance} = FO_1 - FO_5 = \text{Rs. } 1,68,000 - \text{Rs. } 1,66,320$$

$$\text{or } 1,680 \text{ (A).}$$

Computation of Variable and Fixed Overhead Variances and Reconciliation Statement

Problem 12'11. The following information was obtained from the records of a manufacturing unit using standard costing system.

	Standard	Actual
Production	4,000 units	3,800 units
Working days	20	21
Fixed Overhead	Rs. 40,000	Rs. 39,000
Variable Overhead	12,000	12,000

You are required to calculate the following overhead variances :

(a) Variable overhead variance

(b) Fixed overhead variance :

(i) Expenditure variance (ii) Volume variance

(iii) Efficiency variance (iv) Calendar variance.

(c) Also prepare a reconciliation statement for the standard fixed expenses worked out at Standard Fixed Overhead Rate and the Actual Fixed Overhead.

(C.A. Inter May, 1985)

Solution. (a) For Variable Overhead Variance :

V_1 —Actual variable overhead = Rs. 12,000

V_2 —Not applicable

V_3 —Standard variable overhead for production $(12,000 \div 4,000)$
 $\times 3,800 = \text{Rs. } 11,400$

Variable overhead variance : $V_1 - V_2$

$= \text{Rs. } 12,000 - \text{Rs. } 11,400 = 600 \text{ (A).}$

(b) For Fixed Overhead Variance :

FO_1 —Actual fixed overhead incurred = Rs. 39,000

FO_2 —Budgeted fixed overhead for the period = Rs. 40,000

FO_3 —Fixed overhead for days/hours available at standard rate during the period

$(\text{Rs. } 40,000 \div 20 \text{ days}) \times 21 \text{ days} = \text{Rs. } 42,000$

FO_4 —Fixed overhead for actual hours worked at standard rate = not applicable.

FO_5 —Standard fixed overhead for production

$$(Rs. 40,000 \div 4,000 \text{ units}) \times 38,000 \text{ units} = Rs. 38,000.$$

Variances :

(i) Fixed Overhead Expenditure Variances :

$$FO_1 - FO_2 = Rs. 39,000 - Rs. 40,000 \text{ or } 1,000 (F)$$

(ii) Fixed overhead calender variance :

$$FO_2 - FO_3 = Rs. 40,000 - Rs. 42,000 \text{ or } Rs. 2,000 (F)$$

(iii) Fixed overhead capacity variance = Nil

(iv) Fixed Overhead Efficiency Variance : $FO_5 - FO_3$ (FO_4 is nil)

$$= Rs. 42,000 - Rs. 38,000 \text{ or } Rs. 4,000 (A)$$

(v) Fixed overhead Volume variance : $FO_3 - FO_5$

$$= Rs. 40,000 - Rs. 38,000 \text{ or } Rs. 2,000 (A)$$

(vi) Fixed overhead variance : $FO_1 - FO_5$

$$= Rs. 39,000 - Rs. 38,000 \text{ or } Rs. 1,000 (A).$$

(c) Reconciliation Statement :

Standard fixed overhead	Rs. 38,000
Less : Fixed overhead expenditure variance	Rs. 1,000 (F)
Less : Fixed overhead calender variance	Rs. 2,000 (F)
Add : Fixed overhead efficiency variance	Rs. 4,000 (A)
	<hr/>
Actual fixed overhead	39,000
	<hr/>

Finding out other overheads variances when overhead cost variance and volume variance are given.

Problem 12'12. A Cost Accountant of a Company was given the following information regarding the overheads for February 1987 :

- Overheads cost variance Rs. 1,400 adverse.
- Overheads volume variance Rs. 1,000 adverse.
- Budgeted hours for February 1987 1,200 hours.
- Budgeted overheads for February 1987 Rs. 6,000.
- Actual rate of recovery of overheads Rs. 8 per hour.

You are required to assist him in computing the following for February 1987 :

- Overheads expenditure variance.
- Actual overheads incurred.
- Actual hours for actual production.
- Overheads capacity variance.
- Overheads efficiency variance.
- Standard hours for actual production.

(C.A. Inter, May 1987)

Solution.**Computation of required Variances for Feb. 1987****(1) Overhead expenditure Variance :**

O.H. Exp. Variance = O.H. cost variance — O.H. volume variance

 \therefore O.H. Exp. Variance = 1,400 (A) — 1,000 (A) or 400 (A)**(2) Actual overhead Incurred :**

Budgeted overhead = Rs. 6,000

Add : O.H. Expenditure Variance = 400*

Actual overhead incurred = 6,400

*Added since it is adverse i.e. Budgeted figure was less than actual figure.

(3) Actual hours for actual production :

(a) Actual overhead incurred, = Rs. 6,400

(b) Actual rate of recovery of overheads Rs. 8 per hour.

 \therefore Actual hours for actual production (a \div b)

$$= \frac{\text{Rs. 6,400}}{\text{Rs. 8}} = 800 \text{ Hrs.}$$

(4) We know that :FO₁—Budgeted Fixed O.H. for the period Rs. 6,000FO₃—No calender or Idle Time Variance NilFO₄—Fixed overhead for actual hours worked at standard rate

$$\frac{\text{Rs. 6,000}}{1,200 \text{ Hrs}} \times 800 \text{ Hrs or Rs. 4,000.}$$

Fixed overhead capacity variance :

$$= FO_2 - FO_4 = \text{Rs. 6,000} - \text{Rs. 4,000} = \text{Rs. 2,000 (A).}$$

(5) Fixed O.H. Efficiency Variance

= O.H. Volume Variance — OH capacity variance

 \therefore F.O. Efficiency Variance = Rs. 1,000 (A) — Rs. 2,000 (A)

or

Rs. 1,000 (F).

Standard Hours for actual production(6) FO₁—Budgeted Fixed O.H. for the month = Rs. 6,000

Less : O.H. Volume Variance (A) = 1,000

FO₆—Standard fixed overhead for production = Rs. 5,000

Standard hours for production

$$= \frac{1,200 \text{ Hrs}}{\text{Rs. 6,000}} \times \text{Rs. 5,000 or 1,000 Hours.}$$

SALES VARIANCES

Problem 12.13. X Ltd. operates a budgetary control and standard costing system. From the following data calculate :

- (i) Sales variance
- (ii) Sales volume variance
- (iii) Sales price variance.

Product	Budgeted		Actual	
	Units to be sold	Sales value (Rs.)	Units sold	Sales value (Rs.)
A	100	1,200	100	1,100
B	50	600	50	600
C	100	900	200	1,700
D	75	450	50	300
	<u>325</u>	<u>3,150</u>	<u>400</u>	<u>3,700</u>

(C.S. Final June 1987)

(h) For Sales Variances :

SV_1 —Actual Sales realisation given=Rs. 3,700

SV_2 —Actual sales at Std. Price.

Products	Units Sold	Std. Price	Amount
A	100	Rs. 12	Rs. 1,200
B	50	Rs. 12	600
C	200	Rs. 9	1,800
D	50	Rs. 6	300
	<u>400</u>		<u>Rs. 3,900</u>

SV_4 —Budgeted Sales=Rs. 3,150

Sales Volume Variance :

$$SV_1 - SV_2 = \text{Rs. } 3,700 - \text{Rs. } 3,900 \text{ or Rs. } 200 (A)$$

Sales Price Variance :

$$SV_2 - SV_4 = \text{Rs. } 3,900 - 3,150 \text{ or Rs. } 750 (F)$$

Sales Variances :

$$SV_1 - SV_4 = \text{Rs. } 3,700 - \text{Rs. } 3,150 \text{ or Rs. } 550 (F).$$

Note. There is no need to find out value of SV_3 as Sales Mix Variance has not been asked.

Problem 12.14. Budgeted and actual sales for the month of December 1984 of two products A and B of Messers XY Ltd. were as follows :

Product	Budgeted Units	Sales Price/Unit Rs.	Actual Units	Price/Unit Rs
A	6,000	5.00	5,000 1,500	5.00 4.75
B	10,000	2.00	7,500 1,750	2.00 1.90

Budgeted costs for Products A and B were Rs. 4.00 and Rs. 1.50 per unit respectively. Work out from the above data the following Variances :

- (i) Sales Value Variance (ii) Sales Volume Variance
(iii) Sales Price Variance (iv) Sales Mixture Variance
(v) Sales Quantity Variance. (I.C.W.A. Inter, June, 1985 & Dec. 1984)

Solution.

For Sales Value Variances

SV_1 —Actual sales value realised :

$$\begin{aligned}
 A & (5,000 \times \text{Rs. } 5) + (1,500 \times \text{Rs. } 4.75) = \text{Rs. } 32,125 \\
 B & (7,500 \times \text{Rs. } 2) + (1,750 \times \text{Rs. } 1.90) = 18,325 \\
 & \text{-----} \quad \text{Rs. } 50,450
 \end{aligned}$$

SV_2 —Std. Sales value of actual sales :

$$\begin{aligned}
 A & (6,500 \times \text{Rs. } 5.00) = \text{Rs. } 32,500 \\
 B & (9,250 \times \text{Rs. } 2.00) = 18,500 \\
 & \text{-----} \quad \text{Rs. } 51,000
 \end{aligned}$$

SV_3 —Std. value of actual sales if it had been in the ratio of standard mix

$$\begin{aligned}
 A & 15,750 \times (6,000 \div 16,000) \times \text{Rs. } 5 = \text{Rs. } 29,531 \\
 B & 15,750 \times (10,000 \div 16,000) \times \text{Rs. } 2 = 19,688 \\
 & \text{-----} \quad 49,219
 \end{aligned}$$

SV_4 —Std. value of Sales as per Budget :

$$(6,000 \times \text{Rs. } 5) + (10,000 \times 2.00) = \text{Rs. } 50,000.$$

Sales Value Price Variance : $SV_1 - SV_2 = \text{Rs. } 50,450 - 51,000$

or Rs. 550 (A)

Sales Mix Variance : $SV_2 - SV_3 = \text{Rs. } 51,000 - 49,219$

or Rs. 1,781 (F)

Sales Quantity Variance : $SV_3 - SV_4 = \text{Rs. } 48,219 - 50,000$

or Rs. 781 (A)

Sales Volume Variance : $SV_2 - SV_4 = \text{Rs. } 51,000 - 50,000$

or Rs. 1,000 (F)

Sales Value Variance : $SV_1 - SV_4 = \text{Rs. } 50,450 - 50,000$

or Rs. 450 (F)

Problems Variances (Missing Values)

Problem 12 15. Compute the missing data indicated by the question marks from the following :

	Product R	Product S
Sales Quantity		
Standard (units)	?	400
Actual (units)	500	?
Price/unit	Rs.	Rs.
Standard	12	15
Actual	15	20
Sales price variance	?	
Sales volume variance	1,200 F	
Sales value variance		

Sales Mix variance for both the products together was Rs. 450 F.

"F" denotes Favourable.

(C.A. Inter Nov. 1988)

Solution :

For Calculation of Sales Value Variance for product R

SV_1 — Actual sales value realised = $500 \times \text{Rs. } 15 = \text{Rs. } 7,500$

SV_2 — Standard sales value of actual sales = $500 \times \text{Rs. } 12 = \text{Rs. } 6,000$

SV_3 — For Product R above—it is not relevant, as it relates to sales mix.

SV_4 — Standard sales value as per standard or budget (supposing standard quantity x) = $x \times \text{Rs. } 12$

∴ Sales Price Variance relating to R

$$SV_1 - SV_2 = \text{Rs. } 7,500 - \text{Rs. } 6,000 = \text{Rs. } 1,500 \text{ (F)}$$

Sales volume variance relating to Product R is given as Rs. 1,200 (F)

$$\therefore \text{Rs. } 6,000 - 12x = \text{Rs. } 1,200 \text{ or } x = 400 \text{ units}$$

$$\text{Value of } SV_4 = 400 \times \text{Rs. } 12 = \text{Rs. } 4,800$$

$$\therefore \text{Sales value variance relating to product R} = SV_1 - SV_4 \\ = \text{Rs. } 7,500 - \text{Rs. } 4,800 = \text{Rs. } 2,700 \text{ (F)}$$

Alternatively, Sales value variance = Sales Price Variance plus sales volume variance

$$= \text{Rs. } 1,500 + \text{Rs. } 1,200 = \text{Rs. } 2,700$$

Actual Sales quantity of product S

In this question actual quantity of sales of product S is not given, but sales mix variance of both the products is given as Rs. 450.

∴ Sales Mix for both the products presuming that actual sale of S is x and sales Mix variance is $SV_2 - SV_3$.

SV_2 — Sales value of actual sales (For both products)

$$\left. \begin{array}{l} \text{Product R} \quad 500 \times \text{Rs. } 12 \\ \text{Product S} \quad x \times \text{Rs. } 15 \end{array} \right\} \text{ or } \text{Rs. } 6,000 + 15x \quad \dots(1)$$

SV₂—Standard Sales value of actual sales, if the sales had been in the ratio of standard proportion (for both products).

Product R $(500+x) \div 800 \times (400 \times \text{Rs. } 12)$

Product S $(500+x) \div 800 \times (400 \times \text{Rs. } 15)$

or $\{(500+x) \times 12\} \div 2 + \{500+x \div 2 \times 15\} \div 2 \quad \dots(2)$

Note : In standard proportion of 800 units sales are in ratio of 50%
From (i) and (2).....

$\therefore \{6,000+15x\} - \{(3,000+6x)+(3750+7.5x)\} = \text{Rs. } 450$

or $x = 800$ units.

Now it is possible to find out all values of S.

SV₁—Actual Sales value realised = $800 \times \text{Rs. } 20 = \text{Rs. } 16,000$

SV₂—Standard Sales value of actual sales
 $800 \times \text{Rs. } 15 = \text{Rs. } 12,000$

SV₃—For product 'S' alone mix variance is not relevant

SV₄—Standard sales value as per budget = $400 \times \text{Rs. } 15 = \text{Rs. } 6,000$

\therefore Sales value price variance relating to S = $SV_1 - SV_2$
 $= \text{Rs. } 16,000 - \text{Rs. } 12,000 = \text{Rs. } 4,000 \text{ (F)}$

Sales value volume variance relating to S = $SV_2 - SV_4$
 $= \text{Rs. } 12,000 - \text{Rs. } 6,000 = \text{Rs. } 6,000 \text{ (F)}$

Sales value variance relating to S = $SV_1 - SV_4$
 $= \text{Rs. } 16,000 - \text{Rs. } 6,000 = \text{Rs. } 10,000 \text{ (F)}$

Alternatively, Sales Value Price Variance + Sales Value Volume Variance
 $= \text{Rs. } 6,000 + \text{Rs. } 4,000 = \text{Rs. } 10,000 \text{ (F)}$

INVESTIGATION OF VARIANCES

Problem 12.16. (a) What do you understand by Cost Benefit Analysis. Explain the basic steps involved in a study of Cost Benefit Analysis.

(b) A Company using a detailed system of standard costing finds that the cost of investigation of variances is Rs. 20,000. If after investigation an out of control situation is discovered, the cost of correction is Rs. 30,000. If no investigation is made, the present value of extra cost involved is Rs. 1,50,000. The probability of the process being in control is 0.82 and the probability of the process being out of control is 0.18. You are required to advise

(i) whether investigation of the variances should be undertaken or not ;

(ii) the probability at which it is desirable to institute investigation into variances. (I.C.W.A., Final, June, 1987)

Solution. (a) Please refer to Advanced Cost and Management Accounting—Text, by Saxena and Vashist.

(b) (i) **Whether investigation should be undertaken or not :**

Cost of Investigation :

<i>Situation</i>	<i>Cost (a)</i>	<i>Probability (b)</i>	<i>Effective Cost (a) × (b)</i>
Process under control	20,000	·82	16,400
Process out of control (20,000 + 30,000)	50,000	·18	9,000
Total cost to investigate			25,400

Cost of not to investigate :

Extra cost of correction × Problem of process being out of control
 $= 1,50,000 \times .18 = 27,000$.

Since cost when investigation is undertaken is less than the cost of 'No Investigation' it should be done :

(ii) **Probability at which Investigation into Variances should be instituted**

Finding out the probability at which both costs are equal.

Let x be the probability of process being in control.

$\therefore 1-x$ is probability of process being out of control,

<i>Cost of Investigation</i>				<i>Cost of No Investigation</i>
<i>Process</i>	<i>Cost (1)</i>	<i>Probability (2)</i>	<i>Effective cost (1) × (2)</i>	
In control	20,000	x	$20,000x$	$1,50,000 \times (1-x)$
Out of control	50,000	$1-x$	$50,000 - 50,000x$	or $1,50,000 - 1,50,000x$
Net cost			$50,000 - 30,000x$	

Equating two costs :

$$50,000 - 30,000x = 1,50,000 - 1,50,000x$$

$$1,20,000x = 1,00,000 \text{ or } x = 0.833.$$

At the probability level of 0.83 (Process-in-control), both costs are equal. As this probability level declines, the cost of not investigating will be greater than cost of investigating. If probability level is anywhere below .83, investigation should be instituted.

Investigating/Correction of Variances

Problem 12'17. From the following figures decide whether it is worthwhile to investigate the variance :

	Rs.
1. Cost of investigation of variance	6,400
2. Cost of correction of out-of-control process	20,000
3. Cost of allowing the process to remain out of control	95,000
4. Probability of being in control.	0.90

(I.C.W.A. Final, June 1986)

Solution. Choice is to be made between investigation and not investigation.

A : Expected Cost of investigation

(i) Cost of investigation of variance Rs. 6,400

(This will have to be incurred, if this decision is taken)

(ii) Total cost of correction of out of control situation is Rs. 2,000, but only 10% of this will be incurred, because probability of control is 90%. Therefore, expected cost of correction (10% of Rs. 20,000) Rs. 2,000

Total	<div style="border-top: 1px solid black; border-bottom: 3px double black; padding: 2px 0;">8,400</div>
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B. Expected Cost of allowing the process to remain out of control

Total cost of allowing the process to remain out of control is Rs. 95,000. Probability of control is 90%.

∴ Expected cost of allowing the process to remain out of control—Rs. 95,000 × 10% 9,500

∴ From above, it is clear that expected cost of investigation is less than expected cost of allowing the process to remain out of control. Therefore, advise to management will be to investigate the variance.

Variance Investigation—Use of Probability

Problem 12'18. Dharam Raj & Company uses a basic plan Standard Costing system in its factory. Unfavourable Variances in a process have been about Rs. 2,000 a month. If the cause of variance can be found out, and if that cause is correctible, it will take two months to correct it. The correction, if made, would be effective for two months.

Investigation of variance will cost Rs. 500. Correcting the cause, if a correction cause is found, will cost Rs. 1,000. Management believes the probability of finding a correctible cause is 0·6. Required :

(a) Would you recommend launching an investigation ?

(b) What is the minimum probability of finding a correctible cause that would justify an investigation ?

Solution. (a) It is given that correction of cause of variance would be effective for two months. Thus, the ensuing benefit will be :

Benefit : Rs. 2,000 × 2	=Rs. 4,000
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Less : Cost of correcting the cause	= 1,000
-------------------------------------	---------

Benefit	<div style="border-top: 1px solid black; border-bottom: 3px double black; padding: 2px 0;">3,000</div>
---------	--------------------------------------------------------------------------------------------------------

Probability		0.06
Expected value of benefit	$(3,000 \times 0.06)$	Rs. 1,800
Less : Cost of investigation		500
Net value of benefit		1,300

As there is positive net value, the investigation should be launched.

(b) It has been asked in the question to compute the minimum probability of finding correctible cause that would justify the investigation. In other words, break-even probability is to be found out.

$$\text{Benefit} \times \text{Probability} - \text{Cost} = 0$$

$$\text{Rs. } 3,000 \times p - \text{Rs. } 500 = 0$$

$$p = \text{Rs. } 500 / \text{Rs. } 3,000 \text{ or } 0.17$$

MISCELLANEOUS PROBLEMS

Performance Budget and Profit Plan with Variances

Problem 12.19. The following data relate to a company which had a profit plan approved for selling 5,000 units per month at an average selling price of Rs. 10 per unit. The budgeted variable cost of production was Rs. 4 per unit and fixed costs were budgeted at Rs. 20,000, planned income being Rs. 10,000 per month. Because of shortage of raw materials the plant could produce only 4,000 units and the cost of production was increased by Rs. 0.50 per unit. Consequently the selling price was raised by Re. 1.00 per unit. To modify production processes in order to meet material shortage, the Company incurred an expenditure of Rs. 1,000 in Research and Development. Set out a performance budget and a summary report.

(I.C.W.A. Final, June 1986 R.S.)

Solution.

Performance Budget

(in rupees)

	Original plan	Required plan	Actual
Sales Revenue	$5,000 \times 10 = 50,000$	$4,000 \times 10 = 40,000$	$4,000 \times 11 = 44,000$
Variable cost	$5,000 \times 4 = 20,000$	$4,000 \times 4 = 16,000$	$4,000 \times 4.50 = 18,000$
Contribution	$5,000 \times 6 = 30,000$	$4,000 \times 6 = 24,000$	$4,000 \times 6.5 = 26,000$
Fixed cost	20,000	20,000	21,000
Net income	10,000	4,000	5,000

Summary Report on profit plan

Planned Income Rs. 10,000

(i) Selling Price Variance

$4,000 \times (\text{Rs. } 11 - \text{Rs. } 10)$

Rs. 4,000 (F)

<i>(ii) Variable Cost Variance</i>		
$4,000 \times (\text{Rs. } 4 - \text{Rs. } 4.50)$	2,000 (A)	
<i>(iii) Fixed Cost Variance</i>		
$(\text{Rs. } 21,000 - \text{Rs. } 20,000)$	1,000 (A)	
<i>(iv) Profit Volume Variance</i>		
$(1,000 \times \text{Rs. } 6)$	6,000 (A)	
(Profit lost due to shortage of raw material)		5,000 (A)
Actual Income		<u>5,000</u>

* **Problem 12-20 (Single Plan)** From the information given below relating to a manufacturing company, you are required to:

(a) Write up the cost ledger and prepare a costing Profit and Loss A/c showing the appropriate variances for the year ended 30th April.

(b) Ascertain the profit stated in the financial accounts for the year ended 30th April, and reconcile this with the profit shown in your answer to (a) above.

In addition to the normal financial accounts, the company kept cost control accounts. The balances on these accounts on 30th April of the previous year were as follows :

<i>Particulars</i>	<i>At Standard Cost</i>	
General Ledger Control A/c		Rs. 69,00,000
Raw Materials	Rs. 20,50,000	
Work in Progress	36,80,000	
Finished Goods	11,70,000	
	<u>69,00,000</u>	<u>69,00,000</u>

The following is a summary of transactions during the current year ended 30th April.

(i) Purchase of raw materials on credit	Rs. 80,90,000
(ii) Material price variance, calculated at the time of purchase (adverse)	1,90,000
(iii) Material usage variance (adverse)	50,000
(iv) Direct wages actual (13,00,000 hours)	67,80,000
(v) Standard @ Rs. 5 per hour	65,50,000
(vi) Indirect wages	23,10,000
(vii) Depreciation	10,50,000
(viii) Indirect materials and expenses	19,30,000
(ix) Administration, selling and distribution expenses	58,50,000
(x) Debenture interest	3,60,000
(xi) Donations	20,000
(xii) Grant to staff benevolent fund	2,50,000

(xiii) Materials issued to production at standard prices	80,00,000
(xiv) Factory overheads absorbed to production at Rs. 4'00 per standard direct labour hour	52,40,000
(xv) Sales on credit	3,14,70,000
(xvi) Payments received from borrowers (interest on loans)	70,000
(xxii) Abnormal loss Account	1,00,000

Note : (i) The following items of expenditure and income will not be considered in cost books :

(a) Debenture interest, (b) Donation, (c) Grant to staff benevolent fund (d) Income from interest.

(ii) All variances, viz., material price variance, material usage variance, direct wages variance, overhead variance and abnormal loss will be charged to Costing Profit and Loss A/c. Adm. and selling and distribution overhead will be charged to Costing Profit and Loss A/c.

<i>Opening Stock :</i>	<i>At standard cost</i>	<i>At actual cost</i>
Raw Materials	Rs. 20,50,000	Rs. 21,00,000
Work in progress	36,80,000	36,50,000
Finished Goods	11,70,000	12,50,000
<i>Closing Stock :</i>		
Raw Materials	Rs. 18,00,000	Rs. 17,90,000
Work in progress	34,50,000	35,10,000
Finished Goods	11,90,000	12,00,000

(I.C.W.A. Final, December 1987)

Solution. It is presumed that Single Plan is followed.**(a) Cost Ledger****General Ledger Adjustment A/c**

To Costing P & L	Rs. 3,14,70,000	By Balance c/d	Rs. 69,00,000
„ Balance c/d	64,40,000	„ Raw Mat.	
		Control A/c	80,90,000
		„ D. wages	67,80,000
		„ Factory O.H.	
		Control A/c	
		—Indirect wages	23,10,000
		—Depreciation	10,50,000
		—Indirect Mat.	19,30,000
		„ Adm. & Selling O.H.	58,50,000
		„ Costing P & L A/c	50,00,000
	<u>3,79,10,000</u>		<u>3,79,10,000</u>

Work-in-Progress A/c

To opening stock	Rs. 36,80,000	By Finished Goods	
„ D. Material control A/c	80,00,000	Stock A/c	2,00,20,000
* D. Wages A/c	65,50,000	„ Balance b/d	34,50,000
„ F. O.H. A/c	52,40,000		
	<u>2,34,70,000</u>		<u>2,34,70,000</u>

Finished Goods A/c

To Balance c/d	11,70,000	By Cost of Goods	
„ W.I.P. A/c	2,00,20,000	Sold A/c	2,00,00,000
		„ Balance b/d	11,90,000
	<u>2,11,90,000</u>		<u>2,11,90,000</u>

Raw Material Control A/c

To Balance c/d	Rs. 20,50,000	By Material Price	
„ G.L. Adj A/c	80,90,000	Variance A/c	Rs. 1,90,000
		„ M. usage Variance	
		A/c	50,000
		„ W.I.P. A/c	80,00,000
		„ Costing P & L A/c	1,00,000
		„ By Balance c/d	18,00,000
	<u>1,01,40,000</u>		<u>1,01,40,000</u>

Material Price Variance A/c

To Raw Material Control A/c	Rs. 1,90,000	By Costing P & L A/c	Rs. 1,90,000
	=====		=====

Material Usage Variance A/c

To Raw Material Control A/c	Rs. 50,000	By Costing P & L A/c	50,000
	=====		=====

Direct Wages Control A/c

To G. Ledger Adj. A/c	Rs. 67,80,000	By W.I.P. A/c	Rs. 65,50,000
		„ Wage Cost Variance	2,30,000
	<u>67,80,000</u>		<u>67,80,000</u>

Wage Cost Variance

To D. Wages Control A/c	Rs. 2,30,000	By Costing P & L A/c	Rs. 2,30,000
	=====		=====

Factory Overhead Control A/c

To Cost Ledger control A/c		By W.I.P. A/c	Rs. 52,40,000
—Indirect wages	Rs. 23,10,000	„ Overhead	
—Depreciation	10,50,000	Variance A/c	50,000
—Indirect Material	19,30,000		
	52,90,000		52,90,000
			=====

O.H. Variance A/c

To Factory O.H. Control A/c	Rs. 50,000	By Costing P & L A/c	Rs. 50,000
	=====		=====

Adm., Selling & Distribution O.H.A/c

To G.L Adj. A/c	Rs. 58,50,000	By Costing P and L A/c	Rs. 58,50,000
	58,50,000		58,50,000
			=====

Cost of Goods Sold A/c

To Finished Goods A/c	Rs. 2,00,00,000	By Costing P and L A/c	2,00,00,000
	=====		=====

Sales A/c

To Costing P and L A/c	Rs. 3,14,70,000	By G.L. Adj. A/c	Rs. 3,14,70,000
	=====		=====

Costing Profit and Loss A/c

To Cost of Goods Sold	Rs. 2,00,00,000	By G.L. Adj. A/c	Rs. 3,14,70,000
„ Adm. and Selling O.H. A/c.	58,50,000		
„ Mat. Price var A/c	1,90,000		
„ Material usage A/c.	50,000		
„ Wage cost variance	2,30,000		
„ O.H. variance A/c.	50,000		
„ Abnormal loss A/c.	1,00,000		
„ (Net profit) General Ledger Adj. A/c.	50,00,000		
	3,14,70,000		3,14,70,000
	=====		=====

Profit and Loss A/c for the period ending 30th April 19—

To Opening Inventories	Rs.	By Sales	3,14,70,000
—Raw Mat.	21,00,000	„ closing Inventories	
—W.I.P.	36,50,000	—Raw Mat.	17,90,000
—F. Goods A/c	12,50,000	—W.I.P.	35,10,000
To Purchases of R. Mat.	80,90,000	—F. Goods	12,00,000
„ D. wages	67,80,000	„ Interest on loans	70,000
„ Indirect wages	23,10,000		
„ Indirect Material	19,30,000		
„ Depreciation	10,50,000		
„ Adm. & Selling	58,50,000		
„ Debenture Interest	3,60,000		
„ Donations	20,000		
„ Grant to staff	2,50,000		
„ Net Profit	44,00,000		
	<u>3,80,40,000</u>		<u>3,80,40,000</u>

Statement showing Reconciliation of Cost and Financial A/c

Profit as per Cost Accounts	Rs. 50,00,000
Add : (i) Difference in Valuation of Closing Stock	
W.I.P.	Rs. 60,000
Finished Goods	10,000
(ii) Difference in opening	
W.I.P.	30,000
(iii) Income from Interest	70,000
	<u>1,70,000</u>
	51,70,000
Less : (i) Difference in closing stock of	
Raw Material	10,000
(ii) Difference in Opening Stock.	
(a) Raw material	50,000
(b) Finished stock	80,000
(iii) Purely financial transactions	
(a) Debenture Interest	3,60,000
(b) Donations	20,000
(c) Grant to staff	
benevolent fund	<u>2,50,000</u>
	7,70,000
Profit as per Financial Ledger	<u>44,00,000</u>

VO_1 —Actual hours worked at standard variable overhead rate (7,610 units \times 6 hrs. \times Rs. 0'50) Rs. 22,830

$$= \frac{\text{Standard variable overhead}}{\text{rate per unit}} = \frac{22,500}{7,500} = \text{Rs. 3'00}$$

$$= \frac{\text{Standard variable overhead}}{\text{rate per hour}} = \frac{3'00}{6 \text{ hrs.}} = \text{Rs. 0'50}$$

Variances :

Variable overhead expenditure variance $VO_1 - VO_2$

$$= \text{Rs. 25,090} - \text{Rs. 22,830} \quad \text{or Rs. 2,260 (A)}$$

For Fixed overhead variance

FO_1 —Actual fixed overhead incurred

Total factory overhead—Variable overhead

$$= \text{Rs. 36,340} - \text{Rs. 25,090} \quad \text{or Rs. 11,250}$$

FO_2 —Fixed overhead (as given in budget) Rs. 11,250

FO_3 —Nil. There is no calendar or idle time variance

FO_4 —Actual working hour at fixed overhead standard rate

$$= 46,830 \text{ hrs.} \times \text{Standard FO. rate per hour}^*$$

$$= 46,830 \text{ hrs.} \times \text{Rs. 0'25} \quad \text{Rs. 11,707'50}$$

FO_5 —Standard fixed overhead for the output

$$= 7,610 \text{ units} \times \text{Standard F.O. rate}$$

$$= 7,610 \text{ units} \times \left[\frac{\text{Rs. 11,250}}{7,500 \text{ units}} \right]$$

$$= 7,610 \text{ units} \times \text{Rs. 1'50} \quad \text{or Rs. 11,415.}$$

Variances :

1. Fixed overhead expenditure variance : $= FO_1 - FO_2$

$$= \text{Rs. 11,250} - \text{Rs. 11,250} \quad \text{or Nil}$$

2. Fixed overhead capacity variance : $= FO_2 - FO_4$

$$= \text{Rs. 11,250} - \text{Rs. 11,707'50} \quad \text{or Rs. 457'50 (F)}$$

3. Fixed overhead efficiency variance : $FO_4 - FO_5$

$$= \text{Rs. 11,707'50} - 11,415 \quad \text{or Rs. 292'50 (A)}$$

4. Fixed overhead volume variance : $FO_1 - FO_5$

$$= \text{Rs. 11,250} - \text{Rs. 11,415} \quad \text{or Rs. 165 (F)}$$

* Standard fixed overhead rate per unit

$$= \text{Rs. 11,250} \div 7,500 \quad \text{or Rs. 1'5}$$

Standard fixed overhead rate per hour

$$= \text{Rs. 1'5} \div 6 \quad \text{or Rs. 0'25}$$

Alternatively, Fixed overhead capacity variance + Fixed overhead efficiency variance

$$= \text{Rs. } 457.50 \text{ (F)} + 292.5 \text{ (A)} \quad \text{or} \quad \text{Rs. } 165 \text{ (F)}$$

5. Fixed overhead variance : $FO_1 - FO_2$

$$= \text{Rs. } 11,250 - \text{Rs. } 11,415 \quad \text{or} \quad \text{Rs. } 165 \text{ (F)}$$

Alternatively = Fixed overhead expenses variance + Fixed overhead volume variance

$$= \text{Nil} + \text{Rs. } 165 \text{ (F)} \quad \text{or} \quad \text{Rs. } 165 \text{ (F)}$$

Standard Cost Operating Statement

*Problem 12.22. You are appointed Cost Accountant of Zed Ltd. Given below is the company's operating report for May 1988.

	Standard and Variance	Actual
	Rs.	Rs.
Sales—Budgeted	18,000	
Variances due to :		
Volume of orders	1,000	
Selling price	400	19,400
	-----	-----
Profit—Budgeted	3,800	
Variance due to :		
Sales Volume	240	
Sales Price	400	4,440
	-----	-----
Production Cost Variances :		
Labour—Rate	(250)	
—Efficiency	(100)	(350)
Material		
—Price	150	
—Usage	(60)	90
	-----	-----
Overhead Expenditure—Fixed	100	
Variable	(250)	
Efficiency	200	
Capacity	100	150
	-----	-----
Operating Profit		4,340

Your assistant provides the following information about sales and costs for June 1988 :

Sales	Budgeted units	Sales value	Actual units	Sales value
Product A	250	Rs. 10,000	280	Rs. 10,800
Product B	200	6,000	190	5,500
Product C	150	3,000	180	3,500
		-----		-----
		19,000		19,800

<i>Product</i>	<i>Standard selling price per unit</i>	<i>Standard Product Cost per unit</i>
<i>A</i>	Rs. 40	Rs. 31
<i>B</i>	30	25
<i>C</i>	20	15

Labour :

Standard labour cost per hour	Rs. 0.90
Budgeted hours	4,000
Actual clocked hours	4,400
Standard hours produced	4,500
Actual labour cost	4,260

Materials :

Standard cost of material actually used	5,230
Standard cost of material allowed	5,330
Actual cost of material used	5,430

Overheads :

Budgeted rates of overhead recovery per labour hour :	
Fixed	0.50
Variable	1.00
	<hr/> 1.50 <hr/>
Actual Overhead Costs :	
Fixed	2,000
Variable	4,300
	<hr/> 6,300 <hr/>

Required : Prepare the Operating Statement for June 1988 in the same form as May 1988.

(I C.W.A. Final, June 1988 adapted, C.A. Final, May 1986)

Solution. Calculation of Necessary Variances

For Sales Value Variance

- SV₁—Actual sales value realised Rs. 19,800 (Given)
 SV₂—Standard value of actual sales
 $(280 \times \text{Rs. } 40) + (190 \times 30) + (180 \times 20) = \text{Rs. } 20,500$
 SV₃—not applicable
 SV₄—Standard value of sales as per budget
 $(250 \times \text{Rs. } 40) + (200 \times \text{Rs. } 30) + (150 \times \text{Rs. } 20) = \text{Rs. } 19,000$

Variance :

(1) Sales Value Price Variance : SV₁—SV₂

$$= \text{Rs. } 19,800 - \text{Rs. } 20,500 \quad \text{or} \quad \text{Rs. } 700 \text{ (A)}$$

(2) Sales value quantity variance : $SV_2 - SV_4$

$$= \text{Rs. } 20,500 - \text{Rs. } 19,000 \quad \text{or} \quad \text{Rs. } 1,500 \text{ (F)}$$

For Sales Margin Variance

SM_1 —Actual sales margin on actual sales

	Actual Sales units	Sales Value	Sale Price per unit	Std. Cost per unit (Given)	Profit per unit 3-4	Actual profit 1×5
	(1)	(2)	(3)	(4)	(5)	(6)
A	280	Rs. 10,800	Rs. 38.57	Rs. 31.00	Rs. 7.57	Rs. 2119.6
B	190	5,500	28.95	25.00	3.95	750.4
C	180	3,500	19.44	15.00	4.44	800.0
						<u>Rs. 3,670.00</u>
						<u>=====</u>

SM_2 —Standard sales margin on actual sales

$$280 \times (40 - 31) + 190 \times (30 - 25) + 180 \times (20 - 15)$$

$$= \text{Rs. } 4,370.$$

SM_3 —not applicable

SM_4 —Standard sales margin on standard sales mix :

$$250 \times (40 - 31) + 200(30 - 25) + 150(20 - 15) = \text{Rs. } 4,000$$

Variances :

(3) Sales Margin Price Variance : $SM_1 - SM_2$

$$= \text{Rs. } 3,670 - \text{Rs. } 4,370 \quad \text{or} \quad \text{Rs. } 700 \text{ (A)}$$

(4) Sales Margin Volume Variance : $SM_2 - SM_4$

$$= \text{Rs. } 4,370 - \text{Rs. } 4,000 \quad \text{or} \quad 370 \text{ (F)}.$$

For Material Cost Variances

M_1 —Actual cost of material used—Rs. 5,430

M_2 —Standard cost of material used (Given)—Rs. 5,230

M_3 —not applicable

M_4 —Standard cost of material specified for production—Rs. 5,330.

Variances :

(5) Material Price Variance : $M_1 - M_2$

$$= \text{Rs. } 5,430 - \text{Rs. } 5,230 \quad = \text{Rs. } 200 \text{ (A)}$$

(6) Material quantity variance : $M_2 - M_4$

$$= \text{Rs. } 5,230 - \text{Rs. } 5,330 \quad = \text{Rs. } 100 \text{ (F)}$$

Direct Wage Variance :

L_1 —Actual payment made to workers for actual hours worked

Rs. 4,260

L_1 —Actual payment if workers had been paid at standard rate

$$4,400 \text{ hrs} \times \text{Re. } 0.90 \quad \dots \text{Rs. } 3,960$$

L_2 & L_4 not applicable

L_3 —Standard Labour Cost of output achieved

$$4,500 \text{ hrs} \times \text{Re. } 0.90 \quad \dots \text{Rs. } 4,050$$

Variances :

(7) Wage Rate variance : $L_1 - L_2$

$$= \text{Rs. } 4,260 - \text{Rs. } 3,960 \quad \dots \text{Rs. } 300 \text{ (A)}$$

(8) Wage Efficiency Variance : $L_2 - L_3$

$$= \text{Rs. } 3,960 - \text{Rs. } 4,050 \quad \dots \text{Rs. } 90 \text{ (F)}$$

Fixed Overhead Variance :

FO_1 —Actual fixed overhead incurred : Rs. 2,000 (Given)

FO_2 —Budgeted fixed overhead for the period

$$= 4,000 \text{ hrs} \times \text{Re. } 0.50 \quad \dots \text{Rs. } 2,000$$

FO_3 —not applicable

FO_4 —Budgeted fixed overhead for days/hours available in the period

$$4,400 \times \text{Re. } 0.50 \quad \dots \text{Rs. } 2,200$$

FO_5 —Standard fixed overhead for production

$$4,500 \text{ hrs} \times \text{Re. } 0.50 \quad \text{Rs. } 2,250$$

Variances :

(9) Fixed Overhead Expenditure Variance : $FO_1 - FO_2$

$$= \text{Rs. } 2,000 - \text{Rs. } 2,000 \quad \dots \text{Nil}$$

(10) Fixed Overhead Capacity Variance : $FO_4 - FO_1$

$$= \text{Rs. } 2,000 - \text{Rs. } 2,200 \quad \dots 200 \text{ (F)}$$

(11) Fixed Overhead Efficiency Variance : $FO_5 - FO_4$

$$= \text{Rs. } 2,200 - \text{Rs. } 2,250 \quad \dots 50 \text{ (F)}$$

For Variable Overhead Variance :

VO_1 —Actual variable overhead ...Rs. 4,300

VO_2 —Actual hours worked at standard variable overhead rate

$$4,400 \text{ hrs} \times \text{Re. } 1.00 \quad \dots \text{Rs. } 4,400$$

VO_3 —Standard variable overhead for production

$$4,500 \text{ hrs} \times \text{Re. } 1.00 \quad \dots \text{Rs. } 4,500$$

Variances :

(12) Variable Overhead Expenditure Variance : $VO_1 - VO_2$

$$= \text{Rs. } 4,300 - \text{Rs. } 4,400 \quad \dots \text{Rs. } 100 \text{ (F)}$$

(13) Variable Overhead Efficiency Variance : $VO_3 - VO_2$

$$= \text{Rs. } 4,400 - \text{Rs. } 4,500 \quad \dots \text{Rs. } 100 \text{ (F)}$$

Zed Ltd.
Operating Statement for June 1988 :

	<i>Sl. No. for working of variance</i>	<i>Standard and Variance</i>	<i>Actual</i>
Sales—Budgeted		19,000	
Variance due to :			
Volume	(2)	1,500 (F)	
Price	(1)	700 (A)	19,800
		<hr/>	<hr/>
Profit Budgeted :			
(Refer to SM ₄)		4,000	
Variances due to :			
Volume	(4)	370 (F)	
Price	(3)	700 (A)	3,670
		<hr/>	
Production Cost Variance :			
Labour—Rate	(7)	300 (A)	
—Efficiency	(8)	90 (F)	210 (A)
		<hr/>	
Material—Price	(5)	200 (A)	
Quantity or usage	(6)	100 (F)	100 (A)
		<hr/>	
Overhead :			
Expenditure			
— Fixed	(9)	—	
— Variable	(12)	100 (F)	
Efficiency			
— Fixed	(11)	50 (F)	
— Variable	(13)	100 (F)	
Capacity	(10)	200 (F)	450 (F)
		<hr/>	
Operating Profit			3,810
			<hr/>
Actual cost i.e. (Rs. 5,430 + Rs. 4,260 + Rs. 4,300 + Rs. 2,000)			
			+ 3,810 = Rs. 19,800

Computation of Direct Material/Wages Variances

Problem 12-23. The following standards have been set to manufacture a product :

Direct Material	Rs.
2 units of A @ Rs. 4 per unit	8'00
3 units of B @ Rs. 3 per unit	9'00
15 units of C @ Re. 1 per unit	15'00
	<hr/>
	32'00
Direct labour 3 hrs. @ Rs. 8 per hour	24'00
	<hr/>
Total standard prime cost	56'00
	<hr/>

The company manufactured and sold 6,000 units of the product during the year. Direct material costs were as follows :

12,500 units of *A* at Rs. 4.40 per unit

18,000 units of *B* at Rs. 2.80 per unit

88,500 units of *C* at Rs. 1.20 per unit

The company worked 17,500 direct labour hours during the year. For 2,500 of these hours the company paid at Rs. 12 per hour while for the remaining the wages were paid at standard rate. Calculate materials price variances and usage variances and labour rate and efficiency variances. (C.A. Inter, May 1986)

Solution. For Material Cost Variances

M₁—Actual cost of material used

<i>A</i>	12,500 units × Rs. 4.40 = Rs.	55,000
<i>B</i>	18,000 units × Rs. 2.80 = Rs.	50,400
<i>C</i>	88,500 units × Rs. 1.20 = Rs.	1,06,200
		<hr/>
		2,11,600

M₂—Standard cost of material used

<i>A</i>	12,500 units × Rs. 4.00 = Rs.	50,000
<i>B</i>	18,000 units × Rs. 3.00 = Rs.	54,000
<i>C</i>	88,500 units × Rs. 1.00 = Rs.	88,500
		<hr/>
		1,92,500

M₃—not applicable

M₄—Standard material cost of production

6,000 units × Rs. 32 = Rs. 1,92,000

Variances

Material price variance : M₁—M₂

= Rs. 2,11,600—Rs. 1,92,500 Rs. 19,100 (A)

Material usage variance : M₂—M₄

= Rs. 1,92,500—Rs. 1,92,000 Rs. 500 (A)

For Labour Cost Variance

L₁—Actual wages paid to workers

2,500 hrs × Rs. 12 = Rs. 30,000

15,000 hrs × Rs. 8 = Rs. 1,20,000

1,50,000

L₂—Payment involved, if workers had been paid at standard rate

17,500 hrs × Rs. 8 = Rs. 1,40,000

L_3 and L_4 not required

L_5 — Standard labour cost of output achieved

6,000 units \times Rs. 24 = Rs. 1,44,000

Variances :

Labour Rate Variance : $L_1 - L_2$

= Rs. 1,50,000 — Rs. 1,40,000 = Rs. 10,000 (A)

Labour efficiency variance : $L_2 - L_5$

= Rs. 1,40,000 — Rs. 1,44,000 = Rs. 4,000 (F).

★ **Problem 12-24.** (Working back standard cost using given variances) The following data relate to actual output, costs and variances for the four-weekly accounting period number 4 of a company which makes only one product. Opening and closing work-in-progress figures were the same.

Actual production of Product XY	18,000 units
Actual costs incurred :	(Rs. '000)
Direct materials purchased and used	
1,50,000 kilogrammes	210
Direct wages 32,000 hours	136
Variable production overhead	38
Variances .	(Rs. '000)
Direct materials price	15 Favourable
Direct materials usage	9 Adverse
Direct labour rate	8 Adverse
Direct labour efficiency	16 Favourable
Variable production overhead expenditure	6 Adverse
Variable production overhead efficiency	4 Favourable
Variable production overhead varies with labour hours worked.	
A standard marginal costing system is operated.	

You are required to :

(a) present a standard product cost sheet for one unit of Product XY ;

(b) describe briefly *three* types of standard that can be used for a standard costing system, stating which is usually preferred in practice and why.

(C.I.M.A. London May 1987)

Solution. (a) **Standard product cost sheet for one unit of product XY**

Direct Material 8 kgs \times Rs. 1'5	Rs. 12'00
Direct Wages 2 hrs. \times Rs. 4'00	8'00
Variable overhead 2 hrs. \times Rs. 1'00	2'00
	<hr/>
	22'00
	<hr/>

Workings : (Relevant Model Step is given in bracket)

Direct Materials :

Actual Cost (1,50,000 kgs.)	Rs. 2,10,000
Add : Price Variance (Favourable)	15,000
	<hr/>
Standard Cost of Material used (M_2)	2,25,000
Less : Usage Variance (A)	9,000
	<hr/>
Standard Material Cost of Production (M_4)	2,16,000
	<hr/>

Standard Material Cost per unit = Rs. $2,25,000 \div 1,50,000$ kg.
= Rs. 1.5 per kg.

Usage Variance in quantity = Rs. $9,000 \div$ Rate of per kg. Rs. 1.5
= 6,000 kgs.

\therefore Standard quantity of material for production
= 1,50,000 kg – 6,000 kg. = 1,44,000 kg.

\therefore Standard Material quantity per unit
= 1,44,000 kg. \div 18,000 units = 8 kg.

Labour :

Direct Wages for 32,000 hours	Rs. 1,36,000
Less : Rate Variance	8,000
	<hr/>
Standard Direct Wages for hours used (L_2)	1,28,000
Add : Efficiency Variance	16,000
	<hr/>
Standard Direct Wages for production (L_5)	1,44,000
	<hr/>

Standard Rate of Direct Wages = Rs. $1,28,000 \div 32,000$ hrs.
= Rs. 4 per hour

Efficiency Variance in hours = Rs. $16,000 \div$ Rate of Rs 4 per hour
= 4,000 hours

Standard hours for production
= 32,000 hours + 4,000 hrs. = 36,000 hours.

Standard labour hours per unit of production
= 36,000 hrs. \div 18,000 units = 2 hours. per unit

Overhead :

Actual Cost incurred	Rs. 38,000
Less : Production O.H. Expenditure Variance	6,000
Standard V.O. for actual hours incurred (VO_1)	32,000
Add : Production O.H. Efficiency Variance (VO_4)	4,000
Standard Production Overhead for production	36,000

Standard Variable O.H. Rate per hour = Rs. $32,000 \div 32,000$ hrs.
= Re. 1 per hour.

Production Overhead Efficiency Variance in hours
= Rs. $4,000 \div$ Re. 1 per hour = 4,000 hours.

Standard production overhead hours for production
= 32,000 hrs. + 4,000 hrs. = 36,000 hrs.

Standard production overhead hours per unit of production
= $36,000$ hrs \div 18,000 units = 2 hrs. per unit.

(b) Refer to '*Advance I Cost and Management Accounting—Text*' by Saxena and Vashist.

Standard cost operating statement

***Problem 12.25.** Jumbo Enterprises manufactures one product, and the entire product is sold as soon as it is produced. There are no opening or closing stocks and work-in-progress is negligible. The company operates a standard costing system and analysis of variances is made every month. The standard cost card for the product is as follows :

Direct Material	0.5 kg. at Rs. 4 per kg.	Rs. 2'00
Direct Wages	2 hours at Rs. 2 per hour	4'00
Variable Overheads	2 hours at Rs. 0'30 per hour	0'60
Fixed Overheads	2 hours at Rs. 3'70 per hour	7'40
Standard Cost		14'00
Standard Profit		6'00
Standard Selling Price		20'00

Selling and administration expenses are not included in the standard cost and are deducted from profit as a period cost.

Budgeted output for April 1987 was 5,100 units.

Actual results for April 1987 were as follows :

Production of 4,850 units was sold for Rs. 95,600.

Materials consumed in production amounted to 2,300 kg. at a total cost of Rs. 9,800.

Labour hours paid for amounted to 8,500 hours at a cost of Rs. 16,800.

Actual operating hours amounted to 8,000 hours.

Variable overheads amounted to Rs. 2,600.

Fixed overheads amounted to Rs. 42,300.

Selling and administration expenses amounted to Rs. 18,000.

You are required to :

(a) Calculate all variances.

(b) Prepare an operating statement for the month ended 30th April, 1987. *(C.A. Final, May 1987 & May 1982 Similar)*

Solution.

For Material Cost Variance

M_1 —Actual cost of Material used Rs. 9,800 (given)

M_2 —Standard cost of material used
2,300 kg \times Rs. 4 Rs. 9,200

M_3 —Not applicable

M_4 —Standard material cost of
production 4,850 units \times Rs. 2.00 Rs. 9,700

Material price variance $= M_1 - M_2 = \text{Rs. } 9,800 - \text{Rs. } 9,200$
 $= \text{Rs. } 600(\text{A})$

Material usage variance $= M_2 - M_4 = \text{Rs. } 9,200 - \text{Rs. } 9,700$
 $= \text{Rs. } 500 (\text{F}).$

For Direct Wage Variance

L_1 —Actual payment made to workers for
actual hours worked Rs. 16,800

L_2 —Actual payment involved, if workers had
been paid at standard rate
8,500 hrs \times Rs. 2 Rs. 17,000

L_3 —Not applicable

L_4 —Standard labour cost of labour hours utilized
8,000 \times 2 Rs. 16,000

L_5 —Standard labour cost of output achieved
4,850 units \times Rs. 4.00 Rs. 19,400

Wage rate variance $= L_1 - L_2 = \text{Rs. } 16,800 - 17,000 = \text{Rs. } 200 (\text{F})$

Wage idle time variance $= L_2 - L_4$
 $= \text{Rs. } 17,000 - \text{Rs. } 16,000 = \text{Rs. } 1,000 (\text{A})$

Wage efficiency variance = $L_4 - L_5$

= Rs. 16,000—Rs. 19,400 = Rs. 3,400 (F)

For Variable Overhead Variance

VO_1 —Actual variable overhead incurred Rs. 2,600

VO_2 —Actual hours worked at standard variable overhead rate $8,000 \times \text{Rs. } 0.30$ 2,400

VO_3 —Standard variable overhead for the production $4,850 \times \text{Rs. } 0.60$ 2,910

Variable Overhead Expenditure Variance = $VO_1 - VO_2$

= Rs. 2,600—Rs. 2,400 = Rs. 200 (A)

Variable Overhead efficiency variance = $VO_3 - VO_2$

Rs. 2,400—Rs. 2,910 = Rs. 510 (F).

For Fixed Overhead Variances

FO_1 —Actual fixed overhead incurred Rs. 42,300

FO_2 —Budgeted fixed overhead $5,100 \times \text{Rs. } 7.40$ Rs. 37,740

FO_3 —Fixed overhead for days and hours available (no idle/calendar variance) Nil

FO_4 —Fixed overhead for actual hours worked at standard rate $8,000 \times \text{Rs. } 3.70$ Rs. 29,600

FO_5 —Standard fixed overhead for production $4,850 \times \text{Rs. } 7.40$ Rs. 35,890

Fixed overhead expenditure variance = $FO_1 - FO_2$

= Rs. 42,300—Rs. 37,740 = Rs. 4,560 (A)

Fixed overhead capacity variance = $FO_2 - FO_4$

= Rs. 37,740—Rs. 29,600 = Rs. 8,140 (A)

Fixed overhead efficiency variance = $FO_5 - FO_4$

= Rs. 29,600—Rs. 35,890 = Rs. 6,290 (F)

For Total Sales Margin Variance

Actual Sales Margin

Actual Sale price = Rs. $95,600 \div 4,850$ = Rs. 19.7113

Less : Standard cost 14.0000

Actual sales margin per unit 5.7113

$\therefore SM_1$ —Actual sales margin on actual sales

$4,850 \times \text{Rs. } 5.7113$ Rs. 27,700

SM_2 —Standard margin on actual sales

$4,850 \times \text{Rs. } 6$ Rs. 29,100

SM_3 —not applicable (no mix variance)

SM_4 —Budgeted sales margin as per budget

$5,100 \times Rs. 6$

Rs. 30,600

Sales Margin Price Variance = $SM_1 - SM_3$

= Rs. 27,700 — 29,100 = Rs. 1400 (A)

Sales Margin Volume Variance = $SM_3 - SM_4$

= Rs. 29,100 — Rs. 30,600 = Rs. 1500 (A).

(b) **Operating Statement for the month ending 30th April 1987**

Budgeted profit $5,100 \times 6$

Rs. 30,600

Adjustment of variances

	(F)	(A)	
Sales margin variance	Rs.	Rs.	
Sales margin price		1,400	
Sales margin volume		1,500	
Cost variances			
Material price		600	
Material usage	500		
Labour rate	200		
Labour idle time		1,000	
Labour efficiency	3,400		
Variable overhead expenditure		200	
V.O. efficiency	510		
F.O. expenditure		4,560	
F.O. capacity		8,140	
F.O. efficiency	6,290		
Net effect	10,900	17,400	(—) 6,500*
Actual profit before selling and distribution exp.			24,100
Less : Selling and Dist. Exp.			18,000
Actual profit for the month			6,100

*Since adverse variance is more than favourable variance.

Determination of actual profit

Sales		Rs. 95,600
Less : Material cos	Rs. 9,800	
Labour cost	16,800	
V.O. cost	2,600	
F.O. cost	42,300	
Selling and Admn. Off	18,000	89,500
	-----	-----
Actual profit for the month		6,100

Finding the unknown variances—Working backward

Problem 12.26. The assistant management accountant of your company has been preparing the profit and loss account for the week ended 31st October. Unfortunately, he has had a traffic accident and is now in a hospital, so as senior cost analyst you have been asked to complete this statement. The uncompleted statement and relevant data are shown below :

Week ended 31st October

Sales		Rs.	Rs.
			50,000
Standard cost : direct materials			
direct wages		-----	-----
overhead			
Standard profit			
Variances	Fav./ (adv.)	Fav./ (adv.)	
	Rs.	Rs.	
Direct materials price (100)			
usage (300)			

Total		(700)	
Direct labour : rate			
efficiency			
Total	-----		
Overhead expenditure			
volume			
Total	-----		
Total Variance			-----
Actual Profit			=====

Standard Data

The standard price of direct material used is Rs. 600 per tonne. From each tonne of material it is expected that 2,400 units will be pro-

duced. A forty-hour week is operated. Standard labour rate per hour is Rs. 4. There are 60 employees working as direct labour.

The standard performance is that each employee should produce one unit of product in three minutes. There are four working weeks in October.

The budgeted fixed overhead for October is Rs. 76,800.

Actual Data

Materials used during the week were 20 tonnes @ Rs. 620 per tonne. During the week four employees were paid @ Rs. 4.20 per hour and six were paid @ Rs. 3.80 per hour. Remainder were paid at standard rate. Overhead incurred was Rs. 18,000.

You are required to complete the profit and loss statement for the week ended 31st October. (C.I.M.A. London, Nov. 1986 -- Adapted)

Solution.

Workings :

Step 1. Calculation of actual production

Actual cost of material used
 $20 \text{ tonne} \times \text{Rs. } 620 = \text{Rs. } 12,400$

Less : Adverse material cost variance

Price	Rs. 400	
Usage	Rs. 300	
	----	700

Standard material cost of production 11,700
 =====

It is given that standard material cost for 2400 units is Rs. 600.

$\therefore \text{Actual production} = \frac{2,400 \times 11,700}{600} = 46,800 \text{ units}$

Step 2. Variance Analysis

Material cost variances are given already.

For Direct Wage Variances

L₁—Actual payment made to workers for actual hours worked

4 employees \times Rs. 4.20 \times 40 hrs = Rs. 672

6 employees \times Rs. 3.80 \times 40 hrs = Rs. 912

50 employees \times Rs. 4.00 \times 40 hrs = Rs. 8,000

Rs. 9,584

L₂—Payment involved, if the workers had been paid at standard rate

60 employees \times 40 hrs \times Rs. 4.00 = Rs. 9,600

L₃ and L₄ not applicable because there is no gang variance or idle time variance

L_3 —Standard labour cost of output achieved

$$\frac{3 \times 46,800 \text{ units}}{1 \times 60} \times \text{Rs. } 9,000 = \text{Rs. } 9,360$$

(Given that one unit is produced in 3 minutes)

Variances

$$\text{Wage rate variance} = L_3 - L_2 = \text{Rs. } 9,360 - \text{Rs. } 9,000 = \text{Rs. } 360 \text{ (F)}$$

$$\text{Wage efficiency variance} = L_2 - L_1 = \text{Rs. } 9,000 - \text{Rs. } 8,760 = \text{Rs. } 240 \text{ (A)}$$

For Fixed Overhead Variance.

FO_1 —Actual fixed overhead incurred for 4 weeks = Rs. 19,200

FO_2 —Budgeted fixed overhead for 4 weeks and
(Rs. 76,800 ÷ 4) Rs. 19,200

FO_3 and FO_4 not applicable

FO_5 —For standard fixed overhead for production

Standard fixed overhead rate per hour

$$= \frac{\text{Rs. } 76,800}{60 \text{ employees} \times 4 \text{ weeks} \times 40 \text{ hrs}} = \text{Rs. } 8 \text{ per hour}$$

$$\text{Production in one hour in units} = \frac{60 \text{ minutes}}{3 \text{ minutes}} \times 1 \text{ unit} = 20 \text{ units}$$

$$\text{Standard fixed overhead per unit} = \frac{\text{Rs. } 8.00}{20 \text{ units}} = \text{Re. } 0.40.$$

∴ Standard fixed overhead for production

$$= 46,800 \text{ units} \times \text{Re. } 0.40 = \text{Rs. } 18,720$$

∴ Fixed overhead expenditure variance

$$= FO_1 - FO_5 = \text{Rs. } 18,000 - \text{Rs. } 19,200 = \text{Rs. } 1,200 \text{ (F)}$$

Fixed overhead volume variance

$$= FO_2 - FO_5 = \text{Rs. } 19,200 - \text{Rs. } 18,720 = \text{Rs. } 480 \text{ (A)}$$

Profit and loss statement for week ended 31st October

Sales Rs. 50,000

Standard cost : Direct materials Rs. 11,700

Direct wages 9,360

Overhead 18,720

39,780

Standard Profit

10,220

Variances :

Direct Material : Price (400)*
Usage (300)

Wage : Rate 16
Usage (240)

Overhead : Expenditure	1,200	
Volume	(480)	
	<hr/>	
Total Variance		(204)
		<hr/>
Actual Profit		10,016
		<hr/>

*Bracket indicates adverse.

Problem 12-27 (Use of Partial Plan). The following information is available from the records of Standcost Ltd. which follows the Partial Plan for accounting for standards costs, for October 1987 :

Materials Purchased :	Rs.
10,000 pieces at Rs. 2'20 each	22,000'00
Materials Consumed :	
9,500 pieces at Rs. 2'20 each	20,900'00
Actual wages paid :	
2,475 hours at Rs. 2'50 per hour	6,187'50
Factory Overhead Incurred	11,000'00
Factory Overhead Budgeted	10,000'00

Units produced 900 units. These were sold at Rs. 50 per unit.

Standard Rates and Prices are :

Direct Material Rate Rs. 2'00 per unit
 Standard Input 10 pieces per unit
 Direct Labour Rate Rs. 2'00 per hour
 Standard requirement 2'5 hours per unit
 Overheads Rs. 4'00 per labour hour.

Required :

- Show the Standard Cost Card.
- Compute Cost Variances for October 1987.
- Show the journal entries to record the transactions and disposal of the variances (Narrations are required for journal entries).
- Show :
 - The Material Control Account,
 - The Work in Progress Control Account.

(C.A. Final, November 1987)

Solution. (a) Standard Cost Card (Per Unit)

Direct Material (10 pieces \times Rs. 2'00)	Rs. 20'00
Direct Labour (2'5 hrs \times Rs. 2'00)	5'00
Overheads (2'5 hrs \times Rs. 4'00)	10'00
	<hr/>
	35'00
	<hr/>

(b) For Material Cost Variances

	Rs.
M_1 —Actual cost of material used 9,500 pieces \times Rs. 2'20=	20,900
M_2 —Standard cost of material used 9,500 pieces \times Rs. 2'00	19,000

M_2 —There is no mix variance NIL
 M_4 —Standard material cost of production 900 units \times Rs. 20 18,000

For Direct Wage Variance

L_1 —Actual Payment made to workers
 2,475 hrs \times Rs. 2.50 Rs. 6,187.50

L_2 —Payment involved, if the workers had been
 paid at standard rate 2,475 hrs \times Rs. 2 4,950.00

L_3 —There is no gang variance NIL

L_4 —There is no difference between hours available and
 hours utilized NIL

L_5 —Standard labour cost of production 900 \times Rs. 5 4,500.00

For Factory Overhead Variance

FO_1 —Actual fixed overhead incurred Rs. 11,000

FO_2 —Fixed overhead as per budget 10,000

FO_3 —No calendar variance or idle time NIL

FO_4 —Fixed overhead for actual hours worked at
 standard rate 2,475 hrs \times Rs. 4.00 9,900

FO_5 —Standard fixed overhead for production
 900 units \times Rs. 10.00 9,000

Computation of variance :

Material Price Variance = $M_1 - M_2 = 20,900 - 19,000 = \text{Rs. } 1,900 (A)$

Materials Usage Variance = $M_2 - M_4 = 19,000 - 18,000 = \text{Rs. } 1,000 (A)$

Labour Rate Variance = $L_1 - L_2 = 6187.50 - 4,950 = \text{Rs. } 1237.50 (A)$

Labour Efficiency Variance = $L_2 - L_5 = 4,950 - 4,500 = \text{Rs. } 450.00 (A)$

Factory O.H. Expenditure Variance = $FO_1 - FO_2 = \text{Rs. } 11,000 - 10,000$
 = Rs. 1,000 (A)

Factory O.H. Capacity Variance = $FO_2 - FO_4 = 10,000 - 9,900$
 = Rs. 100 (A)

Factory O.H. Efficiency Variance = $FO_4 - FO_5 = 9,900 - 9,000$
 = Rs. 900 (A)

Total Cost Variance = Material Price Variance + Usage Variance
 + Labour Rate Variance + Efficiency Variance

+ O.H. Expenditure Variance + Capacity Variance + O.H.

Efficiency Variance

= 1,900 (A) + 1,000 (A) + 1,237.50 (A) + 450 (A) + 1,000 (A) + 100 (A)
 + 900 (A)
 = Rs. 6587.50

Note : (c) It is assumed that Partial Plan is used, i.e., (i) W.I.P. account is credited with actual cost and debited with standard cost of production, (ii) material price variance is calculated when material is used in goods completed and goods in progress, and (iii) Balancing figures of W.I.P. A/c are cost variances, which are analysed according to causes.

Journal Entries

<i>Particulars</i>		<i>Dr. (Rs.)</i>	<i>Cr. (Rs.)</i>
(i) Materials Control A/c ...Dr.		22,000	
To General Ledger Adjustment A/c			22,000
(Being the entry for purchase of 10,000 pieces at Rs. 2.20 per piece)			
<hr/>			
(ii) W.I. Progress A/c ...Dr.		20,900	
To Materials Control A/c			20,900
(Being the entry for 9,500 pieces consumed @ Rs. 2.20 per piece)			
<hr/>			
(iii) W.I. Progress A/c ...Dr.		6,187.50	
To Direct Wage Control A/c			6,187.50
(Being the entry for 2,475 hours worked at Rs. 2.50 per hour)			
<hr/>			
(iv) W.I. Progress A/c ...Dr.		11,000.00	
To Overhead Control A/c			11,000.00
(Being the entry for factory overhead incurred)			
<hr/>			
(v) Finished Goods A/c ...Dr.		31,500	
To W.I. Progress A/c			31,500
(Being the entry for 900 finished pieces @ Rs. 35 per unit)			
<hr/>			
(vi) Cost of Sales A/c ...Dr.		31,500	
To Finished Goods A/c			31,500
(Being the cost of 900 units sold during the period)			
<hr/>			
(vii) Material Price Variance A/c ...Dr.		1,900.00	
Material Usage Variance		1,000.00	
Labour Rate Variance		1,237.50	
Labour Efficiency Variance		450.00	
Factory Overhead Expenditure Variance		1,000.00	
Factory Overhead Capacity Variance		100.00	
Factory Overhead Efficiency Variance		900.00	
To W.I. Progress A/c			6,587.50
(Being the entry to analyse the cost variances under partial plan)			

(d) Ledger**Material Control A/c**

To General Ledger	By W.I.P. A/c	Rs. 20,900
Adj A/c	Rs. 22,000 „ Balance c/d	1,100
	<u>22,000</u>	<u>22,000</u>
	=====	=====

Work-in-Progress A/c

	Rs.		Rs.
To Material Control A/c	20,900·00	By Finished Goods	
„ Wages Control A/c	6,187·50	Control A/c	31,500·00
„ Overhead Control A/c	11,000·00	„ Material Price	
		Variance A/c	1,900·00
		„ Material Usage	
		Variance A/c	1,000·00
		„ Labour Rate	
		Variance A/c	1,237·50
		„ Labour Efficiency	
		Variance A/c	450·00
		„ Factory O.H. Exp.	
		Variance A/c	1,000·00
		„ Factory O.H. Capacity	
		Variance A/c	100·00
		„ Factory O.H. Efficiency	
		Variance A/c	900·00
	<hr/>		<hr/>
	38,087·50		38,087·50
	<hr/>		<hr/>

Computation of all variances and their causes

Problem 12·28. A Ltd has a manufacturing division which makes a product to which the following details relate :

		<i>Pet Unit</i>
Materials	: 5 kg. at Rs. 2	Rs. 10
Direct Labour	: 12 hours at Rs. 2	Rs. 24
Variable Overheads	: 12 hours at Re. 1	Rs. 12

Relevant fixed overheads are budgeted at Rs. 10,000 per month and planned output is 2,000 units per month. The selling price is Rs. 55 per unit.

An incentive scheme is in operation in the division concerned whereby employees are paid a bonus of 15% of the standard cost of materials saved and 50% of direct labour time saved valued at standard direct labour hour rate.

During a recent month when output was 1,800 units the following actual results were recorded :

Direct Materials used (8,500 kg.)	Rs. 17,200
Direct Wages (20,000 hours)	42,000
Variable Overhead	22,000
Fixed Overhead	9,800
	<hr/>
	91,000
Net Profit	4,000
	<hr/>
Sales	Rs. 95,000

- (a) Calculate the variance which occurred during the month.
 (b) Calculate the total bonus payments to employees in the division.
 (c) Comment on the major features of your calculations in (a) and (b) and suggest possible causes of the variances. (ICWA Final, Dec. 1986)

Solution. (a) For Material Cost variance

M_1 —Actual cost of material used	Rs. 17,200
M_2 —Standard cost of material used 8500 kg. \times Rs. 2	Rs. 17,000
M_3 —(no mix variance)	Nil
M_5 —Standard material cost of production 1,800 units \times Rs. 10	Rs. 18,000
Material price variance = $M_1 - M_2$ = Rs. 17,200 — 17,000 = Rs. 200 (A)	
Material usage variance = $M_3 - M_4$ = Rs. 17,000 — Rs. 18,000 = Rs. 1,000 (F).	

For Direct Wage Variance

L_1 —Actual payment made to workers for actual hours worked	Rs. 42,000
L_2 —Payment involved, if the workers had been paid at standard rate (20,000 Hrs. \times 2)	Rs. 40,000
L_3 & L_4 (no Gang and Idle time variance)	Nil
L_5 —Standard labour cost of output achieved 1,800 units \times Rs. 24	Rs. 43,200
Wage rate variance = Rs. 42,000 — Rs. 40,000 = Rs. 2,000 (A)	
Wage efficiency variance = Rs. 40,000 — Rs. 43,200 = Rs. 3,200 (F)	

For Variable Overhead Variance

VO_1 —Actual variable overhead incurred	Rs. 22,000
VO_2 —Actual hours worked at standard overhead rate 20,000 hrs. \times 1	Rs. 20,000
VO_3 —Standard variable overhead for the production 1,800 units \times Rs. 12'00	Rs. 21,600
Variable overhead expenditure variance $= VO_1 - VO_2$ $= Rs. 22,000 - Rs. 20,000$	$= Rs. 2,000 (A)$
Variable overhead efficiency variance $= VO_2 - VO_3$ $= Rs. 20,000 - Rs. 21,600$	$= Rs. 1,600 (F)$

For Fixed Overhead Variances

FO_1 —Actual overhead incurred	Rs. 9,800
FO_2 —Budgeted fixed overhead for the period	Rs. 10,000
FO_3 —(no calendar/idle time variance)	Nil
FO_4 —Fixed overhead for actual hours worked at std. rate $\frac{20,000 \text{ Hrs.} \times 10,000}{12 \text{ Hrs.} \times 2000}$	8,333

$$FO_5 \text{—Std. Fixed overhead for Production} = \frac{Rs. 10,000}{2,000} \times 1,800 = 9,000$$

Fixed overhead expenditure variance $= FO_1 - FO_2$ $= Rs. 9,800 - 10,000$	$= Rs. 200 (F)$
Fixed overhead capacity variance $= FO_2 - FO_4$ $= Rs. 10,000 - Rs. 8,333$	$= Rs. 1,667 (A)$
Fixed overhead efficiency variance $= FO_4 - FO_5$ $= Rs. 8,333 - Rs. 9,000$	$= Rs. 667 (F)$

For Sales Margin Variance

Actual selling price (95,000 : 1800)	Rs. 52'7778
Less : Standard cost (Rs. 10 + 24 + 12 + 5)	51'0000
Standard sales margin	1'7778

$$SM_1 \text{—Actual sales margin on actual sales } (1800 \times 1'7778) = Rs. 3,200$$

$$SM_2 \text{—Standard sales margin on actual sales } 1,800 \text{ units} \times (Rs. 55 - 51) = 7,200$$

$$SM_3 \text{—No sales margin mix variance} = \text{Nil}$$

$$SM_4 \text{—Budgeted sales margin as per budget } (2000 \times Rs. 4) = 8,000$$

$$\begin{aligned} \text{Sales margin price variance} &= SM_1 - SM_2 \\ &= Rs. 3,200 - 7,200 = Rs. 4,000 (A) \end{aligned}$$

Sales margin volume variance = $S.M_v = S.M_1$
 $= \text{Rs. } 7,200 - \text{Rs. } 6,400 = \text{Rs. } 800 \text{ (A)}$

Reconciliation (not asked in Question)

Budgeted profit ($2,000 \times \text{Rs. } 4$) Rs. 8,000

Adjustment of variances

	F	A
Sales margin price	Rs.	Rs. 4,000
Sales margin volume		800
Material price variance		200
Material usage variance	1,000	
Wage rate variance		2,000
Wage efficiency variance	3,200	
Variable O.H. variance—Rate		2,000
—Efficiency	1,600	
Fixed overhead variance		
—Expenditure	200	
Capacity		1,667
Efficiency	667	
Net	6,667	10,667
Actual profit for the period		4,000

(-) 4,000*

*Since adverse variance is more than favourable variance.

(b) Computation of Bonus

Standard material allowed for 1,800 units $= 1,800 \times 5 \text{ kg} = 9,000 \text{ kg.}$
 Material actually used $= 8,500 \text{ kg.}$
 Savings 500 kg.

(a) Bonus on material savings

$= 500 \text{ kg.} \times \text{Rs. } 2 \times 0.15 = \text{Rs. } 150$

Hours allowed as per standard $= 1,800 \text{ units} \times 12 \text{ hrs} = 21,600$
 Hours actually used 20,000

Savings (Hours)

1,600

(b) Bonus on saving of hours

$= 1,600 \text{ Hrs} \times \text{Rs. } 2 \times \text{Re } 0.50$

= Rs. 1,600

Total Bonus $\text{Rs. } 150 + \text{Rs. } 1,600$

= Rs. 1,750

(a) + (b)

(c) Main points to be noted are :

1. Sale of 1,800 units should have been sold for Rs. 99,000 and

not for Rs. 95,000. Exact reason for this should be found out

2. Actual sale is less than budgeted. It shows that there is depressing trend for the company. Prices are going down accompanied by decline in sales volume as well.

Problem 12-29 (Miscellaneous). Despite increase in the sales price of its sole product to the extent of 20%, a company finds that it has incurred loss during the year 1986 to the extent of Rs. 3-40 lakhs as against the profit of Rs. 5 lakhs in 1985. The adverse situation is attributed mainly due to increase in variable cost and fixed cost, the increase over the previous years being on an average 15% and 12% respectively. The following figures are extracted from the books of the company.

	1985	(Rs. lakhs)	1986
Sales	120		129.60
Variable cost	100		115
Fixed cost	15		18

You are required to analyse the variances relating to Sales, Fixed and Variable overheads over the year in order to bring out the reasons for the fall in profit.

(I.C.W.A. Inter, December 1987)

Solution.

1. Statement showing Profit and Loss [during the years under consideration.

	1985	(Rs. in lakhs)	1986
Sales	120		129.60
Less : Variable Cost	100		115.00
Contribution	20		14.60
Less : Fixed Cost	15		18.00
Profit/(Loss)	5		(3.40)

2. Analysis of Variances

- (i) For Sales Variances :

	(Rs. in lakhs)
SV_1 —Sales of 1986	129.60
SV_2 —Sales at prices of 1985 $(129.60 \div 120) \times 100$ (20% increase)	108.00
SV_3 —Sales of 1985, which is basis for comparison	120.00
Sales Price Variance = $SV_1 - SV_2 = 129.60 - 108 = \text{Rs. } 21.6 \text{ (F)}$	
Sales Volume Variance = $SV_2 - SV_3 = 108.00 - 120.00 = \text{Rs. } 12.00 \text{ (A)}$	
Sales Value Variance = $SV_1 - SV_3 = 129.60 - 120.00 = \text{Rs. } 9.60 \text{ (F)}$	

- (ii) For Variable Cost Variance

	(Rs. in lakh)
VO_1 —Actual variable overhead	Rs. 115.00
VO_2 —Variable overhead at 1985 (15% increase) $(115 \div 115) \times 100$	100.00
VO_3 —Variable Overhead of 1985	100.00
Variable O.H. Expenditure Variance = $VO_1 - VO_2 = \text{Rs. } 115 - \text{Rs. } 100$ = Rs. 15 (A)	

There is no variable overhead efficiency variance, since VO_2 and VO_3 have the same value.

(iii) For Fixed Overhead Variance

	(Rs. in lakhs)
FO_1 —F.O. incurred	Rs. 18'00
FO_2 —Overhead at 1985 level $(18 \div 112) \times 100$	16'07
FO_3 —Fixed overhead of 1985, which is basis for comparison	15'00

$$\text{Fixed Overhead Expenditure Variance} = FO_1 - FO_2 \\ = \text{Rs. } 18'00 - \text{Rs. } 16'07 = \text{Rs. } 1'93 \text{ lakhs (A)}$$

$$\text{Fixed Overhead Volume Variance} = FO_2 - FO_3 \\ = \text{Rs. } 16'07 - \text{Rs. } 15'00 = \text{Rs. } 1'07 \text{ lakhs (A)}$$

3. Reconciliation Statement

Loss for the year 1986	Rs. 3'40 lakh
Add : Favourable Sales Price Variance	21'60 "
	<hr/> 35'00 "

Less Adverse Variance :

(i) Sales Volume Variance	Rs. 12'00 lakhs	
(ii) V.O.H. Exp. Variance	15'00 "	
(iii) F.O. Exp. Variance	1'93 "	
(iv) F.O. Volume Variance	1'07 "	30'00
	<hr/>	<hr/>
Profit in the year 1985		5'00

Alternatively :

Profit in 1985	5'00
Add : Favourable Variance	21'60
	<hr/> 26'60
Less : Adverse Variance detailed above	30'00
	<hr/>
Loss in 1986	3'40

Preparation of actual and Standard cost sheet and their reconciliation when all variances are given

*Problem 12'30. The budgeted output of a single product manufacturing company for 1984-85 was 5,000 units. The financial results in respect of actual output of 4,800 units achieved during the year were as under :

Direct Material	Rs. 29,700	Fixed overheads	Rs. 39,000
Direct Wages	44,700	Profit	36,600
Variable overheads	72,750	Sales	2,22,750

The standard direct wage rate is Rs. 4.50 per hour and the standard variable overhead rate is Rs. 7.50 per hour.

The cost accounts recorded the following variances for the year :

<i>Variances</i>	<i>Favourable</i>	<i>Adverse</i>
Material price	Rs. —	Rs. 300
Material usage	—	600
Wage rate	750	—
Labour efficiency	—	2,250
Variable overhead expense	3,000	—
Variable overhead efficiency	—	3,750
Fixed overhead expense	—	1,500
Selling price	6,750	—

Required to:

- (i) Prepare a statement showing the original budget.
- (ii) Prepare the standard product cost sheet per unit.
- (iii) Prepare a statement showing the reconciliation of originally budgeted profit and actual profit.

(C.A. Final, May 1985, I.C.W.A. Inter, June, 1984—Similar)

Solution. (i) & (ii) Statement showing the original budget and Standard Cost Sheet per Unit :

<i>Particulars</i>	<i>Actual cost, profit and sales of 4,800 units</i>	<i>Adjustment of Variances</i>		<i>Standard cost, profit and sales of 4,800 units</i>	<i>Standard cost, profit and sales for 5,000 units</i>	
		<i>Favourable</i>	<i>Adverse</i>		<i>Total</i>	<i>Per unit</i>
	<i>Total</i>			<i>Total</i>	<i>Total</i>	<i>Per unit</i>
Sales	Rs. 2,22,750	Rs.	Rs.	Rs.	Rs.	Rs.
Sales price variance		6,750	—	2,16,000	2,25,000	45.00
Direct material	29,700					
Material price variance		—	300			
Material usage Variance		—	600			
Standard material cost				28,800	30,000	6.00

Direct wages	44,700				
Wage rate variance		750	—		
Labour efficiency variance		—	2,250		
Standard Labour cost				43,200	45,000 9'00
Variable overheads	72,750				
V.O. expenditure variance		3,000	—		
V.O. efficiency variance		—	3,750		
Standard variable overhead				72,000	75,000 15'00
Fixed overheads	39,000				
Fixed overhead exp. variance		—	1,500		
Budgeted F.O.				37,500	37,500 7'50
Cost of sales	1,86,150			1,81,500	1,87,500 37'50
Profit	36,600			34,500	37,500 7'50

(iii) Statement showing the reconciliation of original budgeted profit and actual profit :

Budgeted profit		Rs. 37,500
Add : Favourable cost variances		
Wage rate	Rs. 750	
Variable overhead expense	3,000	3,750
		41,250
Add : Sales price variance		6,750
		48,000
Less : Adverse cost variances :		
Material price	Rs. 300	
Material usage	600	
Labour efficiency	2,250	
Variable overhead efficiency	3,750	
Fixed overhead expense	1,500	8,400
		39,600

Less : Sales margin volume
variance

[5,000—4,800=200 units
× Rs. 7.50 profit per unit]

1,500

38,100

Less : Fixed overhead volume
variance

[200 units × Rs. 7.50 bud-
geted fixed overhead per unit]

1,500

Actual profit

36,600

Reconstruction of standard cost sheet with incomplete data

Problem 12-31. X Co., manufactures metal furniture for the house. One of these as a product Y with plastic upholstery. During February, 1984 a fire in X Co's office destroyed the only copy of the master set of standards for the product Y. All of the data on operations for January, 1984 are shown below :

Production materials 1500 standard units labour and overhead 1,200 standard units materials issued :

Metal 15,000 kg

Plastic 3,100 kg

Cost Metal Rs. 8,250.00, Plastic Rs. 3,255.00

Direct labour ; Rs. 19,000.00

Actual overhead : Fixed Rs. 6,560, Variable Rs. 3,950

Direct labour hours worked : 5,000

Variances : Metal : Price Rs. 750 (unfavourable), Usage Nil

Plastics : Price Rs. 155 (unfavourable), usage Rs. 100 (unfavourable)

Direct labour : Rate Rs. 1000 (favourable), efficiency Rs. 800 (unfavourable)

Variable overhead : total variance Rs. 350 (unfavourable)

Fixed overhead : Budget Rs. 40 (favourable)

Capacity Rs. 600 (favourable)

Reconstruct the company's standard cost sheet for the product Y and find out standard cost per unit of product Y based on the number of units budgeted.
(ICWA Final, Dec. 1985)

Solution. Standard Cost Sheet for the product Y

Elements of cost	Actual		Standard		
	Qty.	Amount	Qty.	Rate	Amount
Material	kg.	Rs.	kg.	Rs.	Rs.
Metal	15,000	Rs. 8 250			

*Less : Price
variance*

— 750(A)

15,000 kg 7,500

Usage variance Nil Nil 15,000 kg 0 50 7,500

Plastic 3100 kg. 3,255

*Less : Price
variance*

— 155 (A)

3,100kg 3,100

*Less : Usage
variance*

100 kg¹ 100 (A) 3,000 kg 1'0 3,000

Hrs.

Direct Labour 5,000 Rs. 19,000

Add : rate variance 1,000 (F)

5,000 20,000

Less : Efficiency

variance (200 hrs.²) 800 (A) 4,800 hrs 4'00 19,200

Variable overhead 3,950

Less : Variance 350 (A) 3,600

Fixed overhead 6,560

Add : Budget variance 40 (F)

Add : Capacity variance 600 (F) 7,200

Total Standard cost

40,500

**Standard Cost per unit of product Y
based on number of units budgeted**

<i>Element of cost</i>	<i>Qty.</i>	<i>Rate</i>	<i>Amount</i>
Material		Rs.	Rs.
Metal 15,000 kg 1500 units	10 kg per unit	0'50	5'00
Plastic 3,000 kg 1,500 units	2 kg per unit	1'00	2'00
			7'00

Direct Labour

4,800 hrs	4 hrs per unit	4'00	16'00
1200 unit			23'00

Variable Overhead

3,600	Rs. 3 per unit	3'00
1,200 units		

Fixed Overhead

7,200	Rs. 6 per unit	6'00
1,200 unit		

Standard cost per unit of product Y	32'00
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Working Notes

1. For usage variance, adjustment will have to be made both in quantity and value at the rate of Re. 1 per kg

i.e., Rs. $3,100 \div 3,100$ kg

2. For efficiency variance, adjustment will have to be made both in hours and value at the rate of Rs. 4'00 per hour (Rs. $20,000 \div 5000$ hrs)

Preparation of Direct Material and WIP A/c and computation of all variances

Problem 12.32. Budgeted and standard data for a product include the following :

Direct labour

10 employees work a 45 hour week. Standard rate of pay is Rs. 4 per hour. Output per hour is 40 kg. of product

Overhead

Budgeted fixed overhead is Rs. 2,70,000 p.a. Budgeted output is 90,000 kg. p.a. A 50-week year is operated.

Direct materials

Material	Quantity	price per kg
X	60 kg.	Rs. 2'00
Y	40	1'00
Z	100	1'40.

From this standard mix, 180 kg. of products are expected

Actual data for the first week in April were :

Hours worked	45
Rate of pay	Rs. 4 per hour
Overhead incurred	—Rs. 5,400
Output	1980 kg.

Production and consumption of materials were :

<i>Material</i>	<i>Quantity</i>	<i>Price per kg</i>
<i>X</i>	700 kgs	Rs. 1'80
<i>Y</i>	440	1'10
<i>Z</i>	1,120	1'30

You are required to :

(a) Calculate the following variances for each material

direct material — total
— price
— usage
— mix

(b) Calculate the following variances

— direct material yield
— direct labour efficiency
— overhead volume

(c) Show the following accounts :

— direct material
— work in progress

(ICMA, London, May 1985—Adapted)

Solution.

For Material Cost Variances

M₁—Actual cost of material used

<i>Material</i>	<i>kg</i>		<i>Actual Price</i>	
<i>X</i>	700	×	Rs. 1'80	=Rs. 1,260
<i>Y</i>	440	×	Rs. 1'10	=Rs. 484
<i>Z</i>	1120	×	Rs. 1'30	=Rs. 1,456
	<u>2,260</u>			<u>Rs. 3,200</u>

M₂—Standard cost of material used

<i>Material</i>	<i>kg</i>		<i>Std. Price</i>	
<i>X</i>	700	×	Rs. 2'00	=Rs. 1400
<i>Y</i>	440	×	1'00	440
<i>Z</i>	1120	×	1 40	1568
	<u>2,260</u>			<u>3408</u>

M_3 —Standard cost of Material, if it had been used in standard proportion

Material kg

$$X \frac{60}{200} \times 2,260 \times \text{Rs. } 2 = \text{Rs. } 1,356$$

$$Y \frac{40}{200} \times 2,260 \times \text{Rs. } 1 = \text{Rs. } 452$$

$$Z \frac{100}{200} \times 2,260 \times \text{Rs. } 1.40 = \text{Rs. } 1,582$$

3,390
=====

M_4 —Standard cost of material mix specified for production

$$X \frac{60}{180} \times 1,980 \times 2.00 = \text{Rs. } 1,320$$

$$Y \frac{40}{180} \times 1,980 \times 1.00 = \text{Rs. } 440$$

$$Z \frac{100}{180} \times 1,980 \times 1.40 = \text{Rs. } 1,540$$

3,300

(a) Variances :

Material price variance : $M_1 - M_3$

$$X \quad \text{Rs. } 1,260 - \text{Rs. } 1,400 = \text{Rs. } 140 \text{ (F)}$$

$$Y \quad \text{Rs. } 484 - \text{Rs. } 440 = \text{Rs. } 44 \text{ (A)}$$

$$Z \quad \text{Rs. } 1,456 - \text{Rs. } 1,568 = \text{Rs. } 112 \text{ (F)}$$

$$\text{Total material price variance} = 208 \text{ (F)}$$

Material mix variance : $M_3 - M_4$

$$X \quad \text{Rs. } 1,400 - \text{Rs. } 1,356 = 44 \text{ (A)}$$

$$Y \quad \text{Rs. } 440 - \text{Rs. } 452 = 12 \text{ (F)}$$

$$Z \quad \text{Rs. } 1,568 - \text{Rs. } 1,582 = 14 \text{ (F)}$$

$$\text{Total material mix variance} = 18 \text{ (A)}$$

Material usage variance $M_2 - M_4$

$$X \quad \text{Rs. } 1,400 - \text{Rs. } 1,320 = \text{Rs. } 80 \text{ (A)}$$

$$Y \quad \text{Rs. } 440 - \text{Rs. } 440 = \text{Nil}$$

$$Z \quad \text{Rs. } 1,568 - \text{Rs. } 1,540 = \text{Rs. } 28 \text{ (A)}$$

$$\text{Total material price variance} = 108 \text{ (A)}$$

(b) Material yield variance : $M_3 - M_4$

X	Rs. 1,356—Rs. 1,320	=Rs. 36 (A)
Y	Rs. 452—Rs. 440	=Rs. 12 (A)
Z	Rs. 1,582—Rs. 1,540	=Rs. 42 (A)
		<u>Rs. 90 (A)</u>
Total material yield variance		<u>Rs. 90 (A)</u>

For Direct Labour Efficiency Variance

L_4 —Actual payment made to workers if payment had been made at standard rate $45 \times 10 \times \text{Rs. } 4$ =Rs. 1,800

L_5 —Standard labour cost of output achieved

$$\frac{\text{Rs. } 1,800}{45 \text{ hrs} \times 40 \text{ kg}} \times 1,980 \text{ kg} = \text{Rs. } 1,980$$

Labour efficiency variance : $L_4 - L_5$
 =Rs. 1800—Rs. 1,980 or Rs. 180 (F)

For Overhead volume variance

FO_4 —Budgeted Fixed overhead for the period

$$\text{Rs. } \frac{2,70,000}{50} = \text{Rs. } 5,400$$

FO_5 —Standard fixed overhead for production

$$\frac{\text{Rs. } 5,400}{45 \text{ week} \times 40 \text{ kg}} \times 1,980 \text{ kg} = \text{Rs. } 5,940$$

Overhead Volume Variance : $FO_4 - FO_5$
 =Rs. 5,400—Rs. 5,940 or Rs. 540 (F)

(c) Assuming an integrated costing system with partial plan.

Direct Material Account

To Creditors		Rs.	By Work-in-progress	
X	Rs. 1,260		X 700 kg at Rs. 2'00=	Rs. 1,400
Y	484		Y 440 kg at Rs. 1'00=	440
Z	1,455	3,200	Z 1,120 kg at Rs. 1'40=	1,568
				<u>3,408</u>
To Direct Material				
Price Variance A/c		208		
		<u>3,408</u>		<u>3,408</u>

Work-in-Progress

To Direct Materials A/c	3,408	By Material Mix variance A/c	18
„ Direct wages A/c	1,800	„ Material yield variance A/c	90
„ Fixed overhead A/c	5,400	„ Finished stock A/c	11,220
„ Direct wage efficiency A/c	180	1,980 kg @ Rs. 5'667 per kg	
„ Fixed overhead volume variance	540		
	<u>11,328</u>		<u>11,328'00</u>

Finding the unknown variances (Fill in the blanks)

***Problem 12'33.** A company with two cost centres 1 and 2 manufactures two products K and P whose standard variable costs of production per article are :

Product K

Cost Centre		Quantity units	Price/Rate per unit	Total
1	Direct material 101	12	Rs. 5	P.s. 60'00
2	Direct material 102	4	15	60'00
		hours	per hour	Rs.
1	Direct labour			
	Grade A	10	3'40	34'00
1	Direct labour			
	Grade B	6	2'40	14'40
2	Direct-labour			
	Grade C	16	1'80	28'80
1	Variable overhead	16	0'60	9'60
2	Variable overhead	16	0'50	8'00
				<u>214'80</u>

Product P

Cost Centre		Quantity	Price/Rate per unit	Total
1	Direct material 101	16	Rs. 5	Rs.80'00
2	Direct material 103	6	4	24'00

		<i>hours</i>	<i>Rs. per hour</i>	<i>Rs.</i>
1	Direct labour Grade B	14	2.40	33.60
2	Direct labour Grade C	12	1.80	21.60
1	Variable overhead	14	0.60	8.40
2	Variable overhead	12	0.50	6.00
				<hr/> 173.60 <hr/>

Budget data for a period of four weeks each of 40 hours are :

	<i>Product K</i>	<i>Product P</i>
Standard selling price per article	Rs. 315	Rs. 270
Budgeted output on which standard costs are based	330 articles	570 articles
Budgeted Sales for period No 10	320 articles	620 articles
Fixed production overhead :		
Cost centre 1	Rs. 26,520	
Cost centre 2	Rs. 18,180	

Marketing and administration Costs total Rs. 18,000 per period and are treated as fixed costs. Actual data for period No 10 were :

	<i>No. of Articles</i>	
	<i>Product K</i>	<i>Product P</i>
Actual output	300	600
Actual Sales :		
at standard price	290	500
at Rs. 360 each	50	Nil
at Rs. 255 each	Nil	60

Cost :

Cost Centre 1

Direct materials 101	15,600 units at Rs. 4.60 per unit
Direct materials 102	NIL
Direct materials 103	NIL
Direct Labour Grade A	2,880 hours at Rs. 3.70 per hour
Direct Labour Grade B	11,000 hours at Rs. 2.20 per hour
Direct labour Grade C	NIL

Overhead :

Variable	Rs. 7,680
Fixed	Rs. 28,200

Cost Centre 2

Direct materials 101	NIL
Direct materials 102	1,120 units at Rs. 15.00 per unit
Direct materials 103	4,160 units at Rs. 4.20 per unit
Direct labour Grade A	NIL
Direct labour Grade B	NIL
Direct labour Grade C	12,720 hours at Rs. 1.30 per hour

Overhead :

Variable	Rs. 7,360
Fixed	Rs. 17,000

Opening and closing stocks of raw materials and work-in-progress were constant.

The company absorbs fixed production overhead into product by means of cost centre direct hour rates. All variances are transferred to the profit and loss account. Marketing and administration costs were at the budget level. You are required in respect of period No. 10 to :

(a) Calculate the cost variances marked with a (?) in the following table :

<i>Cost Variances</i>	<i>Cost Centre 1</i>	<i>Cost Centre 2</i>
	Rs.	Rs.
(i) Direct materials price	6,240 (Fav.)	?
(ii) Direct materials usage	12,000 (Adv.)	?
(iii) Direct labour efficiency	?	1,296 (Adv.)
(iv) Direct labour rate	?	Nil
(v) Production overhead efficiency	?	1,440 (Adv.)
(vi) Production overhead expenditure	1,032 (Adv.)	?
(vii) Production overhead capacity	?	900 (Fav.)

(b) Present a profit and loss statement for the company that incorporates cost variances by cost centres.

(I.C.M.A. London, May 1985—Adapted)

Suggested Approach. Production overhead i.e., Fixed overhead + Variable overhead is asked for in this question. First find fixed overhead rate per hour for both the centres and add to it variable overhead rate to arrive at production overhead rate. Then find out cost per unit of K and P and proceed further based on questions asked.

Solution. Necessary Workings**1. Determination of Fixed Overhead Rate per unit**

	Cost Centre 1		Cost Centre 2
Fixed overhead for the period as per budgets	Rs. 26,520		Rs. 18,180
	<u> </u>		<u> </u>
Total labour hours to be worked in each cost centre as per budget	Hrs.		Hrs.
Gr. A—330 K units × 10 hrs.	3,300		—
Gr. B—330 K units × 6 hrs.	1,980	Gr. C—330 K units × 16 hrs.	5,280
Gr. C—570 P units × 14 hrs.	7,980	Gr. C—570 P units × 12 hrs.	6,840
	<u> </u>		<u> </u>
	13,260		12,120
	<u> </u>		<u> </u>
Fixed overhead rate per hour	Rs. 2'00		Rs. 1'50
Variable overhead rate per hour	Rs. 0'60		0'50
	<u> </u>		<u> </u>
Production overhead rate per hour	Rs. 2'60		Rs. 2'00
	<u> </u>		<u> </u>

2. Standard Cost sheet for each product

Products	K		P
Selling price	Rs. 315'00		Rs. 270'00
	<u> </u>		<u> </u>

Total Cost**Direct Material**

101—12 × Rs. 5 = Rs. 60'00		101—16 × Rs. 5 = Rs. 80'00	
102— 4 × Rs. 15 = Rs. 60'00	120'00	103— 6 × Rs. 4 = Rs. 24'00	104'00
	<u> </u>		<u> </u>

Direct Labour

A—10 hrs × Rs. 3'40 = Rs. 34'00			
B— 6 hrs × Rs. 2'40 = Rs. 14'40		B—14 hrs × Rs. 2'40 = 33'60	
C—16 hrs × Rs. 1'80 = Rs. 28'80	77'20	C—12 hrs × Rs. 1'80 = 21'60	55'20
	<u> </u>		<u> </u>

Variable Overhead

Cost Centre 1		Cost Centre 2	
16 hrs × Re. 0'60 = Rs. 9'60		14 hrs × Re. 0'60 = 8'40	
Cost Centre 2		Cost Centre 2	
16 hrs × Re. 0'50 = Rs. 8'00	17'60	12 hrs × Re. 0'50 = 6'00	14'40
	<u> </u>		<u> </u>

Fixed Overhead

(Based on labour hour)

Cost Centre 1

A—10 hrs \times Rs. 2 = Rs. 20'00

Cost Centre 1

B—6 hrs \times Rs. 2 = Rs. 12'00

Cost Centre 2

C—16 hrs \times Rs. 1'5 = 24'00

Cost Centre 1

B—14 hrs \times Rs. 2 = 28'00

Cost Centre 2

C—12 hrs \times Rs. 1'50 = 18'00

	56'00	46'00
Total cost	270'80	219'60
Profit	44'20	50'40

(a) Computation of Variances

(i) Cost Centre 2—For Direct Material Price

 M_1 —Actual cost of material used $(1,120 \text{ units} \times \text{Rs. } 15'00) + (4160 \text{ units} \times \text{Rs. } 4'20) = \text{Rs. } 34,272$ M_2 —Standard cost of material used $(1,120 \text{ units} \times \text{Rs. } 15) + (4,160 \text{ units} \times \text{Rs. } 4) = \text{Rs. } 33,440$ **Direct Material Price Variance : $M_1 - M_2$** $= \text{Rs. } 34,272 - \text{Rs. } 33,440 = \text{Rs. } 832 \text{ (A)}$

(ii) Cost Centre 2—For Direct Material usage variance

 M_3 —Standard cost of material used $(1120 \text{ units} \times \text{Rs. } 15) + (4160 \text{ units} \times \text{Rs. } 4) = \text{Rs. } 33,440$ M_4 —Standard material cost of output $(300 \text{ units} \times 4 \times \text{Rs. } 5) + (600 \text{ units} \times 6 \times 4) = \text{Rs. } 32,400$ **Direct Material usage variance : $M_3 - M_4$** $= \text{Rs. } 33,440 - \text{Rs. } 32,400 = \text{Rs. } 1,040 \text{ (A)}$

(iii) Cost Centre 1—For Direct labour efficiency variance

 L_1 —Payment involved, if the workers had been paid at standard rate $(2,880 \text{ hrs} \times \text{Rs. } 3'40) + (11,000 \text{ hrs} \times \text{Rs. } 2'40) = \text{Rs. } 36,192$ L_2 —Standard labour cost of output achieved $(300 \text{ units} \times 10 \text{ hrs} \times \text{Rs. } 3'40) + (300 \text{ units} \times 6 \text{ hrs} \times \text{Rs. } 2'40) + (600 \text{ units} \times 14 \text{ hrs} \times \text{Rs. } 2'40) = \text{Rs. } 34,680$ **Direct Labour Efficiency Variance : $L_1 - L_2$** $= \text{Rs. } 36,192 - \text{Rs. } 34,680 = \text{Rs. } 1,512 \text{ (A)}$

(iv) Cost Centre 1—For Direct Labour Rate Variance

L_1 —Actual payment made to workers for actual hours worked

$$(2,880 \text{ hrs} \times \text{Rs. } 3.70) + (11,000 \text{ hrs} \times \text{Rs. } 2.20) = \text{Rs. } 34,856$$

L_2 —Payment involved, if the workers had been paid at standard rate

$$(2,880 \text{ hrs} \times 3.40) + (11,000 \text{ hrs} \times \text{Rs. } 2.40) = \text{Rs. } 36,192$$

Direct Labour Rate Variance : $L_1 - L_2$

$$\text{Rs. } 34,856 - \text{Rs. } 36,192 = \text{Rs. } 1,336 \text{ (F)}$$

(v) Cost Centre 1—For production efficiency variance

FO_4 —Production overhead for actual hours worked at standard rate

$$(2,880 \text{ hrs.} \times \text{Rs. } 2.60) + (11,000 \text{ hrs} \times \text{Rs. } 2.60) = \text{Rs. } 36,088$$

FO_6 —Production overhead for the production

$$(300 \text{ units} \times 16 \text{ hrs} \times \text{Rs. } 2.60) + (600 \text{ units} \times 14 \text{ hrs} \times \text{Rs. } 2.60) = \text{Rs. } 34,320$$

Production overhead efficiency variance

$$\text{Rs. } 36,088 - \text{Rs. } 34,320 = \text{Rs. } 1,768 \text{ (A)}$$

(vi) Cost Centre 2—For production overhead expenditure variance

FO_1 —Actual production overhead incurred

i.e., Fixed overhead + Variable overhead

$$= \text{Rs. } 17,000 + \text{Rs. } 7,360 = \text{Rs. } 24,360$$

FO_2 —Production overhead for the period

$$= \text{Rs. } 18,180 \text{ (Given)} + 12,720 \text{ hrs.} \times \text{Rs. } 0.50 = \text{Rs. } 24,540$$

Production Overhead Expenditure Variance

$$\text{Rs. } 24,360 - \text{Rs. } 24,540 = \text{Rs. } 180 \text{ (F)}$$

(vii) Cost Centre 1—For production overhead capacity variance

FO_3 —Production overhead for the period

$$\text{Rs. } 26,520 + 13,880 \text{ hrs} \times \text{Rs. } 0.60 = \text{Rs. } 34,848$$

FO_4 —Production overhead for actual hours worked at standard rate
 $(2,880 \text{ hrs} \times \text{Rs. } 2.60) + (11,000 \text{ hrs} \times \text{Rs. } 2.60) = \text{Rs. } 36,088$

Production capacity variance : $FO_3 - FO_4$

Since FO_3 is nil, here it will be $FO_4 - FO_3$

$$\text{Rs. } 34,848 - \text{Rs. } 36,088 = 1240 \text{ (F)}$$

(b) Profit and loss statement for period's Budgeted Profit

K 320 units \times Rs. 44.20

Rs. 14,144

P 620 units \times Rs. 50.40

Rs. 31,248

Rs. 45,392

Problem 12.34. The Managing Director of your company has been given the following statement showing the results for a recent month :

Month ending 31st October 1985

	<i>Master Budget</i>	<i>Actual</i>	<i>Variance</i>
Units produced and sold	10,000	9,000	(1,000)
Sales	Rs. 40,000	Rs. 35,000	Rs. (5,000)
Direct materials	10,000	9,200	800
Direct wages	15,000	13,100	1,900
Variable overheads	5,000	4,700	300
Fixed overheads	5,000	4,900	100
	35,000	31,900	3,100
Net surplus	5,000	3,100	(1,900)

Figures in parentheses indicate adverse variances.

The standard costs of the product are as follows :

	per unit
Direct materials (1 kg at Re. 1 per kg)	Rs. 1.00
Direct wages (1 hour at Rs. 1.50)	1.50
Variable overheads (1 hour at Re. 0.50)	0.50

Actual results for the month showed that 9,800 kg of material were used and 8,800 labour hours were recorded :

(a) Prepare a flexible budget for the month and compare with the actual results.

(b) Calculate the variances which have arisen.

(c) Comment on the calculations you have made in (a) and (b).

(I.C.W.A. Final, June 1986)

Solution.

(a) Statement showing flexible budget for the month and its comparison with actual.

	<i>Master Budget</i>		<i>Flexible Budget</i>	<i>Actual</i>	<i>Variance</i>
Units produced and sold	For 10,000	per unit	For 9,000	For 9,000	—
	Rs.	Rs.	Rs.	Rs.	Rs.
Sales	40,000	4.00	36,000	35,000	1,000(A)
Direct material	10,000	1.00	9,000	9,200	200(A)
Direct wages	15,000	1.50	13,500	13,100	400 (F)
Variable overhead	5,000	0.50	4,500	4,700	200(A)
Total Variable Cost	30,000	3.00	27,000	27,000	—

Contribution	10,000	1'00	9,000	8,000	1,000(A)
Fixed overhead	5,000	0'50	5,000	4,900	100(F)
Net surplus	<u>5,000</u>	<u>0'50</u>	<u>4,000</u>	<u>3,100</u>	<u>900(A)</u>
	=====	=====	=====	=====	=====

(b) Calculation of Variances :**For Calculation of Material Cost Variances**

M_1 —Actual cost of material used	9,200
M_2 —Standard cost of material used (9,800 kg \times Rs. 1)	9,800
M_3 —not applicable	
M_4 —Standard material cost of output (9,000 units \times Rs. 1)	9,000

Variances :

Material price variance ($M_1 - M_2$) i.e., Rs. 9,200—Rs. 9,800	=Rs. 600 (F)
Material usage variance ($M_2 - M_4$) i.e., Rs. 9,800—Rs. 9,000	=Rs. 800 (A)
Material cost variance ($M_1 - M_4$) i.e., Rs. 9,200—Rs. 9,000	=Rs. 200 (A).

For Direct Wage Variances

L_1 —Actual payment made for actual hours worked	Rs. 13,100
L_2 —Payment involved, if the workers had been paid at standard rate (8,800 hrs \times Rs. 1'50)	Rs. 13,200
L_3 and L_4 —not applicable	
L_5 —Standard labour cost of output achieved (9,000 units \times Rs. 1'50)	Rs. 13,500

Variances

Wages rate variance ($L_1 - L_2$) i.e., Rs. 13,100—Rs. 13,200	=Rs. 100 (F)
Wages efficiency variance ($L_2 - L_5$) i.e., Rs. 13,200—Rs. 13,500	=Rs. 300 (F)
Wages cost variances ($L_1 - L_5$) i.e., Rs. 13,100—Rs. 13,500	=Rs. 400 (F)

For Variable Overhead Variances

VO_1 —Actual variable overhead incurred	Rs. 4,700
VO_2 —Actual hours worked at standard variable overhead rate (8,800 hrs \times Re. 0'50)	Rs. 4,400
VO_3 —Standard variable overhead for production (9,000 units \times Rs. 0'50)	Rs. 4,500

Variances

Variable overhead expenditure variance

$$(VO_1 - VO_2) \text{ i.e., Rs. 4,700 - Rs. 4,400 = Rs. 300(A)}$$

Variable overhead efficiency Variance

$$(VO_2 - VO_3) \text{ i.e., Rs. 4,400 - Rs. 4,500 = Rs. 100 (F)}$$

Variable overhead variance ($VO_1 - VO_3$)

$$\text{i.e., Rs. 4,700 - Rs. 4,500 = Rs. 200 (A)}$$

For Fixed Overhead Variance

FO ₁ —Actual Fixed overhead incurred	Rs. 4,900
-------------------------------------------------	-----------

FO ₂ —Budgeted fixed overhead	Rs. 5,000
------------------------------------------	-----------

FO₃—Not applicable

FO ₄ —Fixed overhead for actual hours worked at standard rate (8800 hrs × Rs. 0.50)	Rs. 4,400
---------------------------------------------------------------------------------------------------	-----------

FO ₅ —Standard fixed overhead for production (9,000 units × Rs. 0.50)	Rs. 4,500
-------------------------------------------------------------------------------------	-----------

Variances

Fixed overhead expenditure variance

$$(FO_1 - FO_2) \text{ i.e., Rs. 4,900 - Rs. 5,000 = Rs. 100 (F)}$$

Fixed overhead capacity variance

$$(FO_2 - FO_4) \text{ i.e., Rs. 5,000 - Rs. 4,400 = Rs. 600(A)}$$

Fixed overhead efficiency variance

$$(FO_4 - FO_5) \text{ i.e., Rs. 4,400 - Rs. 4,500 = Rs. 100(F)}$$

Fixed overhead variance ($FO_1 - FO_5$)

$$\text{i.e., Rs. 4,900 - Rs. 4,500 = Rs. 400 (A).}$$

For Sales Margin Variance

SM₁—Actual sales margin on sales effected, i.e., the
difference between standard cost and realisation from
actual sales, i.e., Rs. 35,000 — (9,000 × 3.50)

Rs. 3,500

$$\left[\text{Standard cost per unit} = \frac{\text{Rs. 35,000}}{10,000 \text{ units}} \text{ or Rs. 3.50} \right]$$

SM₂—Standard margin on actual sales effected
(9,000 × Re. 0.50)

Rs. 4,500

SM₃—not applicable

SM₄—Standard sales margin on budgeted sales
(10,000 × Re. 0.50)

Rs. 5,000

VariancesSales margin price variance ($SM_1 - SM_2$)

$$\text{i.e., Rs. 3,500 - Rs. 4,500}$$

Rs. 1,000 (A)

Sales margin quantity variance ($SM_3 - SM_4$)	
i.e., Rs. 4,500—Rs. 5,000	Rs. 500 (A)
Sales margin variance ($SM_1 - SM_4$)	
i.e., Rs. 3,500—Rs. 5,000	Rs. 1,500 (A)

Summary

Sales margin variance	1,500 (A)
Material cost variance	200 (A)
Direct wage variance	400 (F)
Variable overhead variance	200 (A)
Fixed overhead variance	400 (A)
	<hr/>
Total Variance for Master Budget	1900(A)
	<hr/>

(c) **Comments** on calculation made in (a) & (b). The statement as per (b) shows an overall adverse variance of Rs. 1,900. Out of this, sales price variance of Rs. 1,000 requires immediate attention. Material usage is of the magnitude of Rs. 800 (A). This should also attract immediate attention, since this shows lack of efficiency and care in use of material. Capacity variance of Rs. 600 (A) is also alarming. Variable overhead variance is Rs. 200 (A). This should also be probed.

Finding out actual data when all variances are given

Problem 12-35. (a) A company manufactures a food product, data for which for one week have been analysed as follows :

Standard cost data :

	Rs.
Direct materials : 10 units of Rs. 1.50	15
Direct wages : 5 hours at Rs. 4.00	20
Production overhead : 5 hours at Rs. 5.00	25
	<hr/>
	Rs. 60
	<hr/>

Other overhead may be ignored.

Profit margin is 20% of sales price.

Budgeted sales are Rs. 30,000 per week.

Actual data :

Sales	Rs. 29,880
Direct materials	Rs. 6,435
Direct wages	Rs. 8,162

Analysis of variances :

		Adverse	Favourable
Direct materials :	price	585	
	usage		375
Direct labour :	rate		318
	efficiency	180	
Production overhead:	expenditure		200
	volume		375

It can be assumed that the production and sales achieved resulted in no changes of stock.

You are required, from the data given, to calculate :

- (i) the actual output ;
- (ii) the actual profit ;
- (iii) the actual price per unit of material ;
- (iv) the actual rate per labour hour ;
- (v) the amount of production overhead incurred ;
- (vi) the amount of production overhead absorbed ;
- (vii) the production overhead efficiency variance ;
- (viii) the selling price variance ;
- (ix) the sales volume profit variance.

(b) In analysing variances, it is found frequently that an adverse variance from one standard is related directly to a favourable variance from another.

Give two examples of such a situation and comment briefly on each.

(I.C.M.A. London, May 1984—Adapted May, 1986—Similar)

Solution.

(a) (i) **Actual Output :**

Actual direct wage cost	Rs. 8,162
Less : Adverse labour efficiency variance	180
	<hr/> 7,982
Add : Labour rate variance	318
	<hr/> 8,300
	<hr/>

$$\begin{aligned} \text{Output} &= \frac{\text{Total standard direct wage cost}}{\text{Standard direct wages per unit}} \\ &= \frac{8,300}{20} \quad \text{or } 415 \text{ units} \end{aligned}$$

Alternatively,

Actual direct materials	Rs. 6435
Less : Adverse material price variance	585
	<hr/> 5,850
Add : Favourable material usage variance	375
	<hr/> 6,225
	<hr/>

$$\text{Output} = \frac{6,225}{15} \quad \text{or 415 units}$$

(a) (ii) **Actual Profit :**

Actual Sales Rs. 29,880

Less : Direct Material Rs. 6,435

Direct wages 8,162

Production Overhead

$$415 \times 25 = \text{Rs. 10,375}$$

Less : Favourable overhead variances

Expenditure 200

Volume 375 575 9,800 24,397

5,483

(a) (iii) **The actual price per unit of material**

Direct materials Rs. 6,435

Less : Adverse price variance 585

Standard material cost 5,850

Units of material consumed

$$= \frac{\text{Standard material cost}}{\text{Standard price per unit}}$$

$$= \frac{5,850}{1.5} = 3,900 \text{ units.}$$

Actual price per unit of material

$$= \frac{\text{Rs. 6,435}}{3,900} \text{ or Rs. 1.65.}$$

(a) (iv) **Actual rate per labour hour**

Actual direct wages Rs. 8,162

Add : Favourable rate variances 318

Standard wages 8,480

$$\text{Actual hours worked} = \frac{\text{Standard wages}}{\text{Rs. 20}} \times 5 \text{ hrs}$$

$$= \frac{8,480}{20} \times 5 = 2120 \text{ hrs.}$$

Actual rate per labour hour

$$= \frac{8,162}{2120} = \text{Rs. 3.85}$$

(a) (v) The amount of production overhead incurred

Standard production overhead = 415×25 or Rs. 10,375

Less : Favourable variances

Expenditure	200	
Volume	375	575
		<hr/>
		9,800
		<hr/>

(a) (vi) the amount of production overhead absorbed

= Units produced \times Standard OH absorption rate

= $415 \times \text{Rs. } 25$ or Rs. 10,375.

(a) (vii) Production Overhead efficiency variance

FO₁—Actual Fixed overhead incurred 9,800

FO₂—Budgeted fixed overhead for the period (400×25) Rs. 10,000

FO₃—Fixed overhead for days/hours available in budget Nil

FO₄—Fixed overhead for actual hours worked or standard rate ($2120 \text{ hrs} \times \text{Rs. } 5$) Rs. 10,600

FO₅—Standard fixed overhead for production ($415 \text{ units} \times 5 \text{ hrs} \times \text{Rs. } 5$) Rs. 10,375

Production overhead efficiency variance

= FO₄ — FO₅

= Rs. 10,600 — Rs. 10,375 = Rs. 225 (A).

(a) (viii) Selling Price Variance

SV₁—Actual Sales value realised (Given) 29,880

SV₂—Standard value of actual sales — 415×75 = Rs. 31,125

Selling Price Variance = SV₁ — SV₂
Rs. 29,880 — Rs. 31,125 = Rs. 1,245 (A)

(a) (ix) the sales volume profit variance

SV₃—Standard sales margin on actual sales
 $415 \times (20/80 \times 60)$ 6,225

SV₄—Standard sales margin as per standard cost data
 400×15 6,000

\therefore SV₃ — SV₄ or Rs. 6,225 — Rs. 6,000 = Rs. 225 (F)

(b) Two examples whereas adverse variance may be offset by a favourable variance are :

1. **Direct materials :** A favourable price variance may arise when material is purchased at a cheaper price. But the quality may be poor and this may result in inefficient usage causing an adverse usage variance.

2. **Direct wages.** Employing worker of higher grade may lead to adverse wage rate variance. But this may be offset by favourable efficiency variance because more skilled workers do the work in less time than allowed.

Completion of various control ledgers when variances and reconciliation data are given

Problem 12.36. The financial and cost accounts of the MA Manufacturing Company for the year ended 30th September, 1985 have been reconciled as below :

Financial profit and loss account
for the year ended 30th September, 1985.

Raw materials :

Opening stock	Rs. 56,450	Rs.	Cost of goods manufactured	Rs. 8,10,000
Purchases	3,24,560			
	<u>3,81,010</u>			
Closing stock	58,060			
	<u>-----</u>	3,22,950		
Direct wages		2,47,320		
Production salaries		86,465		
Indirect wages		42,321		
Depreciation		50,000		
Power		10,642		
Telephone		8,742		
Rates		16,400		
Insurance		6,475		
Miscellaneous		18,325		
		<u>-----</u>		
		8,09,640		
Work-in-progress :				
Opening stock	18,620			
Closing stock	<u>18,260</u>			
		360		
		<u>-----</u>		
		8,10,000		<u>8,10,000</u>
Finished goods :			Sales	11,03,500
Opening stock	1,42,350			
Manufactured	8,10,000			
	<u>9,52,350</u>			
Closing stock	<u>1,46,850</u>			
	<u>-----</u>	8,05,500		
Gross profit c/d		2,98,000		
		<u>-----</u>		
	Rs. 11,03,500			<u>Rs. 11,03,500</u>

Administration expenses	Rs. 1,24,620	Gross Profit	
Selling and distribution expenses	87,380	b/d	Rs. 2,98,000
Discount allowed	1,240	Discount received	1,600
Debenture interest	6,360		
Net profit c/d	80,000		
	<u>Rs. 2,99,600</u>		<u>Rs. 2,99,600</u>

Reconciliation of Financial and Cost Accounts
Year ended 30th September, 1985

Profit as per financial accounts	Rs. 80,000	Profit as per cost accounts	Rs. 84,550
Discount allowed	1,240	Discount received	1,600
Debenture interest	6,360	Difference in stock valuation :	
Difference in stock valuation :		Raw materials :	
Work-in-progress :		Opening	700
Closing	480	Raw materials :	
Finished goods :		Closing	750
Opening	720	Work-in-progress :	
		Opening	620
		Finished goods :	
		Closing	580
	<u>Rs. 88,800</u>		<u>Rs. 88,800</u>

Data in the cost accounts include :

Direct material price variance	Rs. 3,120 Adverse
Direct material usage variance	1,280 Adverse
Direct labour rate variance	4,160 Favourable
Direct labour efficiency variance	4,470 Favourable
Production overhead expenditure variance	4,880 Favourable
Production overhead volume variance	1,680 Adverse

You are required, from the above data, to show the following accounts as they should appear in the cost ledger :

- (a) stores ledger control ;
- (b) work-in-progress ledger control ;
- (c) finished goods ledger control ;
- (d) profit and loss.

(I.C.M.A., London, Nov. 1985 – Adapted)

Solution.**Working for closing balance as per Cost accounts**

1. Opening raw material as per financial account	56,450
Add : Difference in opening balance as per cost accounts	700
Opening balance as per cost accounts	<u>57,150</u>

Reason. Profit as per cost accounts was less due to this item. It means that opening balance as per cost accounts was more due to this item. Therefore, this balance should be added to opening balance of raw material (as per financial accounts) to get opening balance of raw material as per cost accounts.

2. Opening work-in-progress as per financial accounts	18,620
Add : Difference in opening balance	620
Balance as per cost accounts	<u>19,240</u>

For reason, refer to explanation given for point No. 1

3. Opening balance of finished goods account as per financial account	Rs. 1,42,350
Less : Difference in opening balance	720
Opening Balance as per cost account	<u>1,41,630</u>

Reason : Profit as per cost accounts was more. Figure of opening balance of raw material in cost accounts must have been less than the corresponding figure as per financial accounts. Therefore, this difference should be reduced from opening balance of finished goods as per financial accounts.

4. Closing raw material as per financial accounts	Rs. 58,060
Less : Difference in closing balance	750
Closing balance of raw materials as per cost accounts	<u>57,310</u>

Reason. Closing balance of raw material as per cost accounts was less than the corresponding figure as per financial accounts.

5. Closing work-in-progress as per financial accounts	Rs. 18,260
Add : Difference in closing balance	480
Closing balance of WIP as per cost accounts	<u>18,740</u>

Reason. Closing balance of WIP in cost accounts was more than its corresponding figure in financial accounts.

6. Closing balance of finished goods as per financial accounts	Rs. 1,46,850
Less : Difference in closing balance	580
	<hr/>
Closing Balance of finished goods as per cost accounts	1,46,270
	<hr/>

(a) Accounts as per Cost Ledger :

Stores Ledger Control Account

Opening balance	Rs. 57,150	By WIP A/c	
To Purchases		(Balancing figure)	Rs. 3,21,280
Rs. 3,24,560		By Closing balance	57,310
Less : Price			
Variance (A) 3,120**			
	<hr/>		
	3,21,440		
	<hr/>		
	3,78,590		<hr/>
			3,78,590
			<hr/>

Note. It is presumed that price variance is computed at the time of receipt and that the stocks were held at standard price.

(b) Work-in-progress ledger Control Account

To opening balance	Rs. 19,240	By Material usage	
„ Store control A/c	3,21,280	variance	1,280
„ Direct wages 2,47,320		„ Production over-	
Favourable		head volume	1,680
rate variance 4,160		„ Finished Goods A/c	8,19,020
	<hr/>	(Balancing figure)	
„ Wages efficiency	2,51,480	By Closing balance	18,740
variance 4,470			
„ Production			
overhead 2,39,370			
Add : Favou-			
erable expendi-			
ture variance 4,880**			
	<hr/>		
	2,44,250		
	<hr/>		
	8,40,720		<hr/>
			8,40,720
			<hr/>

**These variances should not be shown in work-in-progress control account, which is debited with standard price of material, wages at standard rate and production overhead as per budget.

(c) **Finished Goods Ledger Account**

To Opening balance	Rs. 1,41,630	By cost of sales A/c (Balancing figure)	8,14,380
„ W.I.P. A/c	8,19,020	„ Closing balance b/d	1,46,270
	<u>9,60,650</u>		<u>9,60,650</u>

(d) **Profit and Loss A/c**

To Cost of Sales A/c	8,14,380	By Sales	11,03,500
„ Material Price Variance A/c	3,120	„ Direct labour rate variance	4,160
„ Material usage Variance	1,280	„ Direct labour efficiency variance	4,470
„ Production overhead Volume Variance	1,680	„ Production overhead expenditure variance	4,880
„ Administration expenses	1,24,620		
„ Selling and Distribution	87,380		
„ Net profit	84,550		
	<u>11,17,010</u>		<u>11,17,010</u>

RATIOS

Problem 12'37. Based on the data given below show the calculation of :

- (i) Efficiency ratio ;
- (ii) Production volume ratio ;
- (iii) Idle capacity ratio.

<i>Data</i>	<i>Standard Hours of output</i>	<i>Hours of actual operations</i>
Theoretical capacity	100	100
Theoretical capacity less		
Unavoidable lost time.	95	95
Planned activity for period	81	90
Actual Activity for period	68	85

(I.C.W.A. Final, Dec. 1985—Adapted)

Solution.**Efficiency Ratio**

$$= \frac{\text{Output expressed in terms of standard hours}}{\text{Actual hours spent for producing that output}} \times 100$$

$$= 68/85 \times 100 \quad \text{or } 80\%$$

Production Volume Ratio or activity ratio

$$= \frac{\text{Actual output in standard hours}}{\text{Budgeted output in standard hours}} \times 100$$

$$= 68/81 \times 100 \quad \text{or } 84\%.$$

(iii) Idle Capacity Ratio

$$= \frac{\text{Practical capacity in standard hours} - \text{Budgeted capacity}}{\text{Practical capacity in standard hours}}$$

$$= (95 - 81)/95 \quad \text{or } 14.7\%.$$

Problem 12.38. The following data have been obtained from the records of a machine shop for an average month :

Budget

No. of working days	25
Working hours per day	8
No of direct workers	16
Efficiency	One standard hour per clock hour
Down time	20%
Overheads :	
Fixed	Rs. 15,360
Variable	20,480

The actual data for the month of September 1985 are as under :

Overheads :	
Fixed	16,500
Variable	14,500
Net operator hours worked	1,920
Standard hours produced	2,112

There was a special holiday in September 1985.

Required to present reports to Departmental Manager :

(i) Showing the three cost ratios you have chosen :

(ii) Setting out the analysis of variances.

(C.A. Final, Nov. 1985)

Solution.**Report to Departmental Manager showing Cost Ratios**

(i) *Efficiency ratio* :

$$= \frac{\text{Output expressed in Std. hrs.}}{\text{Actual hrs. worked}} \times 100$$

$$= (2,112 \div 1,920) \times 100 \quad \text{or } 110\%$$

(ii) *Activity Ratio* :

$$= \frac{\text{Output in Standard hours}}{\text{Budgeted output in SH}} \times 100$$

$$= (2,112 \div 2,560) \times 100 \quad \text{or } 82.5\%$$

(iii) Calender Ratio

$$= \frac{\text{Actual working days in a period}}{\text{No. of working days in related budget period}} \times 100$$

$$= (24 \div 25) \times 100 \quad \text{or } 96\%$$

(iv) Standard capacity usage ratio

$$= \frac{\text{Budget hours}}{\text{Max. No. of hrs. in related period}} \times 100$$

$$= (2,560 \div 3,200) \times 100 \quad \text{or } 80\%$$

(v) Actual usage of Budgeted capacity ratio

$$= (\text{Actual hrs} \div \text{Budgeted hrs}) \times 100$$

$$= (1,920 \div 2,560) \times 100 \quad \text{or } 75\%$$

Workings

Max. hrs. = $25 \times 8 \times 16$	3,200
Budgeted hrs. 3,200 hrs less 20%	2,560
Actual hrs. (given)	1920
Standard hrs. (produced)	2,112
Budgeted working days	25
Actual working days	24

(ii) Report to Departmental Manager setting out the analysis of variances

(A) Fixed Overhead variances

FO ₁ —Actual Fixed overhead incurred	Rs. 16,500
FO ₂ —Budgeted Fixed overhead for the period (given)	Rs. 15,360
FO ₃ —Fixed overhead for the days/hrs available at standard rate during the period ($24/25 \times \text{Rs. } 15,360$)	Rs. 14,746
FO ₄ —Fixed overhead for actual hrs worked at standard rate (Rs. $15,360/2,560 \times 1920$)	Rs. 11,520
FO ₅ —Standard fixed overhead for production ($15,360/2,560 \times 2,112$)	Rs. 12,672

Variances

Fixed overhead expenditure variance : FO ₁ —FO ₂ = Rs. 16,500—Rs. 15,360	or	1140 (A)
Fixed overhead calender variance : FO ₂ —FO ₃ = Rs. 15,360—Rs. 14,746	or	614 (A)
Fixed Overhead capacity variance : FO ₃ —FO ₄ = 14,746—Rs. 11,520	or	Rs. 3,226 (A)

Fixed overhead efficiency variance : $FO_4 - FO_5$
 $= \text{Rs. } 11,520 - \text{Rs. } 12,672$ or Rs. 1,152 (F)

Fixed overhead variance : $FO_1 - FO_5$
 $= \text{Rs. } 16,500 - \text{Rs. } 12,672$ or Rs. 3,828 (A)

Fixed overhead volume variance : $FO_3 - FO_5$
 $= \text{Rs. } 15,360 - \text{Rs. } 12,672$ or Rs. 2,688 (A)

(B) Variable Overheads

VO_1 —Actual variable overhead Rs. 14,500

VO_2 —Actual hrs worked at standard variable overhead rate
 $= \text{Rs. } 20,480 / 2,500 \text{ hrs} \times 1,920 \text{ hrs.}$ Rs. 15,360

VO_3 —Standard variance overhead for production
 $= \text{Rs. } 20,480 / 2,560 \text{ hrs.} \times 2,112 \text{ hrs.}$ or Rs. 16,896

Variances

Variable overhead expenditure variance : $VO_1 - VO_2$
 $= \text{Rs. } 14,500 - \text{Rs. } 15,360$ or Rs. 860 (F)

Variable overhead efficiency variance : $VO_2 - VO_3$
 $= \text{Rs. } 15,360 - \text{Rs. } 16,896$ or Rs. 1,536 (F)

Variable overhead variance : $VO_1 - VO_3$
 $= \text{Rs. } 14,500 - \text{Rs. } 16,896$ or Rs. 2,396 (F)

Authors' Special Notes :

(1) Questions are asked from this chapter at all levels but it is most important for students of C.A. Inter and Final. Atleast one question definitely appears from this chapter in their examinations.

(2) "*Missing Values*"— In questions of this type, correlate the data and come to "unknown value" from the "known values" (Problems P 2-4, 12-20, 12-24, 12-26, 12-31, 12-35, A 11)

(3) In preparation of operating statement and reconciliation, keep in mind that variances are categorised as Favourable or Adverse with reference to their impact on profit (Problem 12-22, 12-24, 12-25, 12-28, 12-29, 12-38)

(4) Questions are asked in variance analysis testing knowledge of 'Cost book-keeping' (Problems 12-32, 12-36).

5. Refer to problem 12-21, which expects use of 'equivalent concept' along with variance analysis.

6. For partial plan and single plan, refer to Problems 12-27, 12-37

7. For relative understanding of model steps, arrange them as follows :

M_1	L_1	VO_1	FO_1	SM_1	SV_1
M_2	L_2	VO_2	FO_2	SM_2	SV_2

M ₂	L ₂	—	FO ₂	SM ₂	SV ₂
—	L ₄	—	FO ₄	—	—
M ₄	L ₄	VO ₂	FO ₆	SM ₂	SV ₄

Note the following common pattern of the Model Steps.

- (i) 1st step is relating to actual everywhere.
- (ii) 2nd step is relating to actual at standard except FO₂.
- (iii) Third step is relating to 'mix' except FO₂.
- (iv) Last step everywhere is relating to output.
- (v) (a) Difference in L₂ and L₄ is due to "hours worked" and "hours utilized"—Note that labour may idle away the time.
- (b) FO₂ is budgeted fixed for the period.

(c) FO₂ "Hours available" and FO₄ "hours worked"—Suppose a factory has 22 hours. There happens a death of a national leader and factory is closed for one day. Workers could not work for half a day due to improper scheduling and waiting for instruction. Here budgeted F.O for 2½ days will be FO₂. Fixed OH for 19 days will be FO₂ and F.O for 18½ day will be FO₄.

BREAK-UP OF PROBLEMS RELATING TO STANDARD COSTING ACCORDING TO DIFFERENT LEVELS (FOR PROBLEMS WITH PREFIX A, REFER TO APPENDIX A)

Intermediate Level

- Direct Material Cost Variances—P 12-1, 12-2, 12-3, 12-4, 12-5, 12-6, A 60, A 68, A 81, A 172.
- Direct Labour Variances—P 12-7, 12-8, 12-23,
- Overhead Variances—P 12-9, 12-10, 12-11, 12-12, 12-14, 12-15, A 104, A 142.
- Missing Values—P 12-4, 12-12.
- Working back standard cost with given variances—P 12-24, A 90
- Operating Statement/Reconciliation—P 12-29, A 16
- Miscellaneous—P 12-23, A 46, A 64, A 79, A 90.

Final Level

- Direct Material—P 12-4
- Investigation of Variances—P 12-16, 12-17, 12-18
- Missing Values—P 12-26, 12-31, 12-33
- Use of Equivalent Concept—A 11, A 111
- Planning and Operating Variances—A 17
- Operating Statement/Reconciliation—P 12-19, 12-22, 12-25, 12-30, A 16, A 24, A 34, A 55, A 72, A 86, A 93, A 122
- Working back Standard cost with given Variances—P 12-24, A 12-26, 12-35
- Variance and Control Ledger—P 12-36, A 62, A 153
- Ratios—P 12-37, 12-38
- Single/Partial Plan—P 12-20, 12-27
- Miscellaneous—P 12-32, 12-34, 12-38

Please also refer to the Examples 13-1 to 13-19 of the book "Advanced Cost and Management Accounting—Text" by Saxena and Vashist

Use of Costs in Pricing Decisions*

[Return on Investment Pricing—13-1—13-10; Intra-division Transfer Pricing : 13-11—13-26]

RETURN ON INVESTMENT PRICING

Cost/Price estimates for quotation purpose (by installing balancing equipment)

Problem 13-1. M/s. N.C. Ltd. has received an enquiry from a reputed cigarette factory for the supply of 20 million shells per month. Capacity exists for the same but a balancing equipment costing Rs. 50,000 has to be installed.

The cost details are as follows :

- | | |
|---------------------------------------|---------------------------------------------------|
| (a) Duplex board | —50 tonnes @ Rs. 5.50 per kg. |
| (b) Printing ink and gum | —Rs. 2 per 1000 shells |
| (c) Packing cost | —Rs. 7.50 per one lakh shells |
| (d) Labour hours | —1,600 hours of which 500 hours will be overtime |
| (e) Labour rate | —Rs. 4 per hour with double the rate for overtime |
| (f) Overheads | —Rs. 16,300 per month |
| (g) Selling and distribution expenses | —Rs. 16,300 per month. |

Since duplex board is in short supply, procurement is made on cash basis. Working capital to the extent of 50% of the sales value will be required.

The company expects a net return of 20% on the additional capital required for undertaking this order.

Prepare a cost estimate and indicate the price to be quoted to the customer. (I.C.W.A. Final, Dec. 1980)

Suggested Approach

In this question sales value is to be determined on the basis of information given, i.e.,

Sales value = Cost + 20% of capital employed.

Cost can be determined on the basis of cost details given.

* This chapter requires emphasis only by Final level students of professional examinations.

Solution (a) Statement showing the cost estimates of cigarette shells for one month

(Quantity to be produced 2,00,000 shells)		Total Cost
Cost elements	Details	
		Rs.
1. Duplex board	50 tonnes @ Rs. 550 per kg.	2,75,000
2. Printing ink and gum	Rs. 2 per 1,000 shells	40,000
3. Packing cost	Rs. 7.50 per one lakh shells	1,500
4. Labour cost	1,100 hours @ Rs. 4 per hour = 4,400 500 hours @ Rs. 8 per hour = 4,000 1,600	8,400
5. Overheads		16,300
6. Selling and distribution		16,300
Total cost for the month		3,57,000

Capital employed means fixed cost plus working capital. It is also given that working capital is 50% of sales value.

$$(b) \text{ Capital employed} = \text{Fixed assets} + \text{Working capital} \\ = \text{Rs. } 50,000 + 0.5 S$$

$$(c) \text{ Return expected} = 20\% \text{ or } \{ \text{Rs. } 50,000 + 0.5 S \}$$

$$(d) \text{ Sales value} = \text{Cost} + \text{Return expected}$$

$$\text{or } S = \text{Rs. } 3,57,500 + 0.2 (\text{Rs. } 50,000 + 0.5 S)$$

$$\text{or } S = \text{Rs. } 3,57,500 + 10,000 + 0.1 S$$

$$\text{or } S - 0.1 S = \text{Rs. } 3,67,500$$

$$\text{or } 0.9 S = \text{Rs. } 3,67,500 \quad \text{or } S = \text{Rs. } 4,08,333$$

Therefore, the price should be quoted at Rs. 4,08.333 for 20 million shells.

Notes 1. In this question working capital is related to the sales value to be quoted. As a matter of fact the working capital should be related to cost of sales (excluding depreciation) instead of sales value. Sales value includes a portion of profit margin, for which no working capital is required.

2. The effective life of the balancing equipment has not been indicated. Therefore, depreciation cannot be worked out.

3. The period of the supply of cigarettes is not indicated and as such long range profitability cannot be measured

Minimum price to be quoted based on profit as a % of capital employed.

Problem 13.2. A company manufactures generators, electric motors, switchgears and other electrical equipment. Using the same fabrication facility it wants to quote the minimum price for the manufacture of 4 sets of generators. The following estimates of costs were drawn by the Engineering Department :

Engineering, design and drawings	Rs. 5 lakhs per set
Material	120
Labour	120
Depreciation	10
Other Overheads	15
Warranties Provision	5

Cost of Sales	Rs. 175 lakhs
	=====

The Management's aim is to make profit of 25% on capital employed. The Sales Manager has recommended a price of Rs. 175+25% =Rs. 218.75 lakhs for the quotation.

As head of Management Service Division, you are required to give your views on the minimum price to be adopted. The following further information is available :

Value of Net Fixed Assets as on date	Rs. 2,000 lakhs
Average rate of depreciation	10%
Working Capital requirements	6 months' cost of sales

You are requested to submit a report to the Management detailing your recommendation on the price that can be quoted :

- if there is no advance payment involved, and
- if the buyer is to make advance payment based on the expected progress of work every month. (I.C.W.A. Final, June 1979)

Suggested Approach

The Management expects to make a profit of 25% on capital employed. Capital employed consists of working capital plus net fixed assets. The working capital requirement is given at 6 months' cost of sales. Value of net fixed assets for the company is given at Rs. 2,000 lakhs. However, net fixed assets employed for a set of generators is not directly available. This is to be found first. Then a minimum price is to be worked after adding a profit margin @ 25% of capital employed. This price is to be compared with the price recommended by sales manager (i.e., cost of sales +25%). Further a minimum price is to be worked when the buyer is willing to make advance payment every month.

Solution. Working showing the Net fixed assets per set.

Net fixed assets of the company		=Rs. 2,000 lakhs
Depreciation @ 10%		=Rs. 200 lakhs
Depreciation per set		=Rs. 10 lakhs
Net fixed assets per set $(2,000 \div 200) \times 10$		=Rs. 100 lakhs per set
Working capital @ 6 months cost of sales	$(175 \times 6/12)$	87.50
Capital employed per set		187.50
Profit margin @ 25% of capital employed		46.875
Cost of sales		175.000
Minimum price per set		221.875
Minimum price for 4 sets with no advance payment		887.500
Minimum price as per sales manager's estimate	$= 218.75 \times 4$	875.000

Thus, a minimum price of Rs. 887.5 lakhs for manufacture of 4 sets of generators should be quoted taking into consideration the policy of management. Sales Manager's estimate is not based on accepted norms of return and he relied on cost-plus pricing policy. This is not based on any scientific basis because it introduces an artificial and arbitrary element.

Minimum price if buyer is willing to make advance payment every month beginning :

If the advance is received at the beginning of each month, the working capital requirement can be met out of the advances and as such no amount is locked up in financing working capital. In that case, capital employed will consist of net fixed assets and return on this is to be allowed :

Cost of Sales	Rs. 175.00 lakhs per set
Return @ 25% on Net fixed assets $(100 \times 25\%)$	25.00
Minimum price per set	200.00
Minimum price for 4 sets	800.00

Note. Working capital is given at 6 months' cost of sales, which includes Rs. 10 lakhs as depreciation. Working capital requirement should be based on cost of sales less depreciation.

Post-tax return on C.E.

***Problem 13-3.** PH Ltd. manufactures and sells two products, namely BXE and DXE. The company's investment in fixed assets is Rs. 2 lakh. The working capital investment is equivalent to three months' cost of sales of both the products. The fixed capital has been financed by term loan lending in instalments at an interest of 11% p.a. Half of the working capital is financed through bank borrowings carrying interest at the rate of 19.4%, the other half of the working capital being generated through internal resources.

The operating data anticipated for 1982-83 are as under :

	Product BXE	Product DXE
Production per annum (in units)	5,000	10,000
Direct material/unit :		
Material A (Price Rs. 4 per kg)	1 kg	0.75 kg
Material B (Price Rs. 2 per kg)	1 kg	1 kg
Direct labour hours	5	3

Direct wage rate Rs. 2 per hour.

Factory overheads are recovered at 70% of direct wages.

Administrative overheads are recovered at 40% of factory cost.

Selling and distribution expenses are Rs. 2 and Rs. 3 per unit respectively of BXE and DXE.

The company expects to earn an after tax profit of 12% on capital employed. The income tax rate is 50%.

Required :

- Prepare a cost sheet showing the element-wise cost, total cost profit and selling price per unit of both the products.
- Prepare a statement showing the net profit of the company after taxes for the year 1982-83. (I.C.W.A., Final, June 1982)

Suggested Approach :

(For Part i) In this question, selling price per unit for each product is to be determined. For this purpose, following two elements are required to be worked out :

- Cost of sales per unit.
- Return per unit.

Determination of cost of sales based on the given data does not present any difficulty. For determination of return per unit, it is necessary to work out capital employed, which means determination of net working capital plus net fixed assets. After this is done, return on capital employed can be easily worked out. It will have two components :

- Return on fixed assets, and
- Return on working capital.

Return on fixed assets should be apportioned based on labour hours, in the absence of machine hours, which might have been a more appropriate method. The return on working capital should be apportioned on cost on sales.

• For part (ii) : For preparation of statement showing the net profit for the company, it is necessary to deduct from sales, the cost of sales, interest and income tax.

Solution.**PH Ltd**

(i) (a) *Statement showing the elementwise cost sheet of products BXE and DXE for the year 1982-83 :*

S. No.	Details	Rs. per unit	
		Product BXE	Product DXE
1.	Direct Materials :		
	A	4.00	3.00
	B	2.00	2.00
		----	----
	Total Direct material	6.00	5.00
2.	Direct wages	10.00	6.00
		----	----
3.	Prime cost (1+2)	16.00	11.00
4.	Factory overheads (50% of direct wages)	5.00	3.00
		----	----
5.	Factory cost (3+4)	21.00	14.00
6.	Administration overheads (40% of factory cost)	8.40	5.60
		----	----
7.	Cost of production (5+6)	29.40	19.60
8.	Selling and distribution expenses	2.00	3.00
		----	----
9.	Total cost of sales (7+8)	31.40	22.60
		-----	-----

(b) *Statement showing the total return for the company.*

Total cost of sales		Total
(Production \times cost of sales per unit)		Rs.
BXE—5,000 units \times Rs. 31.40	=1,57,000	
DXE—10,000 units \times Rs. 22.60	=2,26,000	
Total cost of sales	-----	3,83,000

Working capital @ 3 months' of the the total cost of sales (Rs. 3,83,000 \times 3/12)		95,750
Fixed assets		2,00,000

Capital employed		2,95,750

(c) *Return on fixed assets*

As the basis of allocation of return on fixed assets and working capital are different, it is necessary to work out the return separately on fixed assets and working capital.

Fixed assets	Rs. 2,00,000
Return @ 12% p.a. on fixed assets	24,000
Income tax (50% pretax is equal to 100% post-tax*)	24,000
Total return on fixed assets	48,000
(d) <i>Return on working capital</i>	
@ 12%	11,490
Income-tax (50% pretax is equal to 100% post-tax)	11,490
Total return on working capital	22,980

*Suppose the gross return	Rs. 100
Income tax (50%)	50
Net return	50

$$\% \text{ of Income tax to net return} = \frac{50}{50} \times 100 = 100\%$$

(e) *Allocation of Return to Products BXE and DXE.*

(Machine hours is a more appropriate basis of allocating return on fixed capital. In the absence of this, direct labour hours are taken as basis of allocation.)

	Products	
	BXE	DXE
	Rs.	Rs.
Total Direct labour hours		
Product BXE 5,000 units × 5 hours		
= 25,000		
Product DXE 10,000 units × 3 hrs		
30,000		
55,000		
Total return on fixed assets	48,000	
Share of product BXE = $\frac{25,000}{55,000} \times 48,000$	21,818	
Share of product DXE = $\frac{30,000}{55,000} \times 48,000$		26,182

Allocation of return on working capital based on cost of sales

Cost of sales :

Product *BXE* 5,000 units \times Rs. 31.40 = 1,57,000Product *DXE* 10,000 units \times Rs. 22.60 = 2,26,000

Total cost of sales 3,83,000

Total return on working capital 22,980

Share of product *BXE* $\frac{1,57,000}{3,83,000} \times 22,980$ 9,420Share of product *DXE* $\frac{2,26,000}{3,83,000} \times 22,980$ 13,560

Total return 31,238 39,742

Return per unit 6.248 3.978

Cost of sales per unit 31.400 22.600

Selling price per unit 37.648 26.574

(f) Calculation of Interest :

Interest on fixed capital of Rs. 2,00,000 @ 11% p.a. Rs. 22,000

Interest on half of the working capital : Rs. 47,875 @ 19.4% p.a. 9,288

Total interest 31,288

Note. Under return on capital employed concept, interest is not a part of cost of sales. It is charged directly to profit and loss account.

(i) Statement showing the net profit of the company for the year 1987=83

Sales :

Product *BXL* 5,000 units \times Rs. 37.648 1,88,240Product *DXE* 10,000 units \times Rs. 26.574 2,65,740

Total sales 4,53,980

Less : Cost of sales 3,83,000

Gross profit before interest and tax 70,980

Less : Interest 31,288

Profit after interest but before tax 39,692

Tax @ 50% 19,846

Net profit after tax 19,846

Problem 13.4. (Transfer Pricing) A large public sector company has several manufacturing divisions. Two of these are *AJ* and *DJ* each of which sells most of its output to customers outside the group divisions.

AJ Division operates at full capacity. It can in other words expand its production capacity only at an extra cost. *DJ* on the other hand operates at present at 50% capacity.

DJ is actively seeking profitable ways to utilise its idle capacity. The management of *DJ* has been able to secure an order for 2,000 units of its product 'M' to be delivered over a period of a year at a price of Rs. 105 each. *DJ* can meet this delivery schedule easily and the estimated break-up of cost of this item per unit is as under :

Components purchased from outside market	Rs.	45
Part No. 35 purchased from <i>AJ</i>		10
Factory variable costs		28
Selling overheads—variable		16
		<hr/>
Total cost per unit		99
		<hr/>

Besides this, the interest charges on additional capital required for manufacture of this product will amount to Rs. 1000 p.a.

DJ expects that Part No. 35 will be supplied by *AJ*. This part which is being manufactured by *AJ* is being sold to outside customers at Rs. 15 each and *AJ* has a market for 20,000 units of this part at this price. Even the production in excess of this quantity can be sold by *AJ* to the outside customers at this price. The variable cost of Part 35 to *AJ* is Rs. 8.50 each.

DJ on the other hand would be able to procure Part 35 from outside suppliers at Rs. 15 each, being the same price at which *AJ* sells to outsiders. Since the payment of market price for Part 35 will wipe off the profit, *DJ* has asked the Chief Executive of *AJ* to supply the part at a price of Rs. 10 each.

In case *AJ* is agreeable to supply the part to *DJ*, it has two alternatives namely (a) to supply 2000 parts from its existing productive capacity by diverting supplies from outside customers or (b) to supply 2000 parts by resorting to overtime working leaving the existing capacity of 20,000 units to meet the outside demand. In the event of overtime working, *AJ* will incur additional production costs of Rs. 4,000 on the output of 2000 parts.

Discuss the effect of the following decisions on each of the manufacturing divisions as well as on the overall profitability of the company as a whole with suitable calculations :

- (i) *AJ* supplies part 35 to *DJ* at Rs. 10 each.
- (ii) *AJ* refuses to supply Part 35 at Rs. 10 each but agrees to supply the same at Rs. 15 each by diverting supplies from outside market.

(iii) *DJ* produces product 'M' by using Part 35 purchased from outside market at Rs. 15 each.

(iv) *AJ* manufactures 2000 units of the part by resorting to overtime and supplies the same to *DJ* at Rs. 15 each.

Solution. (I.C.W.A. Final, December 1987)

<i>AJ</i>		<i>DJ</i>	
(i) Sales :		Sales :	
Outside $18,000 \times 15$	Rs. 2,70,000	Outside $2,000 \times \text{Rs. } 105$	Rs. 2,10,000
<i>DJ</i> $2,000 \times 10$	20,000	Variable Cost	
		$2,000 \times \text{Rs. } 99$	1,98,000
Total	2,90,000	Contribution	12,000
Less : Variable cost		Less : Interest	1,000
$(20,000 \times \text{Rs. } 8.50)$	1,70,000		
Contribution	1,20,000	Net contribution	11,000

Total Group Contribution = Rs. 1,31,000

<i>AJ</i>		<i>DJ</i>	
(ii) Sales :		Sales :	
$20,000 \times \text{Rs. } 15$	Rs. 3,00,000	$2,000 \times \text{Rs. } 105$	Rs. 2,10,000
Variable cost		Variable cost	
$(20,000 \times 8.50)$	1,70,000	$2,000 \times (99 + 5)$	2,08,000
		Contribution	2,000
		Less : Interest	1,000
	1,30,000	Net Contribution	1,000

Total Group contribution = Rs. 1,31,000.

<i>AJ</i>		<i>DJ</i>	
(iii) Sales :		Sales :	
$20,000 \times 15$	Rs. 3,00,000	2000×105	2,10,000
Variable cost		Variable Cost	
$(20,000 \times 8.50)$	1,70,000	$(2,000 \times 104)$	2,08,000
		Contribution	2,000
		Less : Interest	1,000
	1,30,000	Net Contribution	1,000

Total Group Contribution = Rs. 1,31,000

<i>AJ</i>		<i>DJ</i>	
(iv) Sales :		Sales :	
22,000 × 15	Rs. 3,30,000	2,000 × 105	2,10,000
Less : V. Cost 1,87,000		V. Cost 2,000 × 104	2,08,000
(22,000 × 8.50)			
Overtime 4,000	1,91,000		2,000
	1,39,000	Interest	1,000
		Net Contribution	1,000

Total Group Contribution = Rs. 1,40,000.

Comments :

Decision 1. The divisional performance of *AJ* will appear relatively poorer. It will show a profit of Rs. 1,20,000, which would have been Rs. 1,30,000 if *AJ* had sold the part to outside supplier. The performance of *DJ* will boost up at the cost of *AJ*. Group income will not change.

Decision 2. *AJ* will maintain its performance, but *DJ*'s contribution will go down to Rs. 1,000 only. Group income will not change.

Decision 3. *AJ* will maintain its performance but *DJ* contribution will go down to Rs. 1,000 only. Group income will not change.

Decision 4. *AJ* performance will boost up where as *DJ* performance will remain at the low level of Rs. 1,000 only.

DJ cannot show better performance except at the cost of *AJ*. *AJ* should not reduce the price, when it has assured market at price of Rs. 15 each.

Overall rate of return on capital employed and post-tax return on net worth

Problem 13.5. A firm's capital employed is financed from different sources as follows :

	Rs. Lakhs
Ordinary share capital	40
10% preference share capital	10
Reserves	50
Long-term loans (12% interest)	80
Working capital loans (18% interest)	20
Total	200

The firm desires to provide a ploughback of profits in the business at 12% of the existing reserves after paying tax and dividend (12% dividend on ordinary shares). Calculate the overall rate of return on capital employed. Is there any difference in the amount of profit (and how much ?) if it is to be provided for at 12% post-tax return on net worth ? Consider the rate of corporate tax @ 55% + 5% surcharge thereon.

(I.C.W.A. Final. June, 1984)

Suggested Approach

Different elements of capital employed are already given in the problem. This problem calls for calculation of gross return on (a) capital employed, and (b) networth. In this case gross return on capital employed involves calculation of interest on long-term and short-term borrowing, dividend on share capital, profit margin on reserves and provision for income tax. The second alternative is to compute return on networth. Capital employed of the company has to be split up into borrowed funds and own capital. Interest has to be computed on borrowed capital whereas 12% return has to be computed in equity or net worth portion after providing for income tax. Gross return so computed has to be related to capital employed.

Solution. Calculation of gross return on capital employed net worth

<i>Component of capital employed</i>	<i>Rs. Lakhs</i>	
Ordinary share capital	40	
10% Preference share capital	10	
Reserves	50	
Net worth	100	
Long-term loans	80	
Working capital loan	20	
Capital employed	200	
	Return on C.E.	Return on Networth
(a) 12% interest on long-term loans	9.60	9.60
(b) 18% interest on working capital loan	3.60	3.60
(c) 12% dividend on ordinary shares	4.80	—
(d) 10% dividend on preference shares	1.00	—
(e) Profit (plough-back @ 12% of existing returns	6.00	—
(f) Return on net worth (12% of Rs. 100)		12.00
(g) Provision for income tax (136.69% of 11.80)	16.13	—
Provision for tax (136.69% of f)	—	16.40
Total gross return	41.13	41.60
Gross return as a % of C.E.	20.565	22.80
Net return on net worth	Rs. 12.00 lakhs	
Net return on C.E.	Rs. 11.80 lakhs	
Difference	Rs. 0.20 lakhs	

*Rs. 11.80.

*Suppose the gross return	=Rs. 100.00
Income tax ($55\% + 5\% = 59.75\%$)	57.75
Net return	42.25

Income tax as a % of net return $(57.75 \div 42.25) \times 100 = 136.69\%$

Computation of price based on profit as a % of S.P

***Problem 13.6.** Megatron Ltd. has entered into a collaboration agreement with Kozuki of Japan for import of T.V. Kit in completely knocked down (CKD) condition. The terms of agreement are as under :

(a) Megatron will import 40% items by value (in terms of FOB price of complete T.V. set) and balance 60% will be locally manufactured purchased.

(b) For all non-standard items which are to be produced locally, Kozuki will provide drawings.

(c) Megatron will pay a lump sum of Rs. 30 lakh for supply of technical know-how and drawings.

(d) Megatron will also pay a royalty at 10% of selling price fixed by it for sale in the local market less landed cost of imported Kit, less cost of standard items purchased locally.

(e) Megatron will send a six monthly return to Kozuki showing No. of sets sold, sale value, standard components costs, landed cost of CKD, etc.

Considering the above terms and additional information given below, calculate the selling price that should be fixed for local sale so as to get 20% profit on selling price. (Round off the answer to nearest rupee)

(i) Agreement expires on production of 3 lakh sets

(ii) FOB price quoted is 1,20,000 yen.

(iii) Insurance and freight Rs. 200 per CKD.

(iv) Customs duty at 140% of CIF price. However, effective rate of duty is only 40% as per Government notification.

(v) Estimated cost of 60% items to be manufactured/procured locally, will be 1.5 times as compared to cost of manufacture by Kozuki. The quoted price by Kozuki contains 20% margin on cost.

(vi) The ratio of standard and non-standard parts is 2 : 3 (in terms of rupee value).

(vii) Assembling and other overhead costs will be Rs. 1000 per set.

(viii) Exchange rate is Rs. 5 per 100 yen.

(I.C.W.A., Final, June, 1986)

Solution.**Statement showing the landed cost
of imported CKD kit**

FOB price	=1,20,000 yen
Conversion rate of 1 yen	=Rs. 0.05
FOB price in local currency (with 100% imported contents)	=Rs. 6,000
FOB price with 40% imported contents	=Rs. 2,400
Add : Freight and insurance	200
	<hr/>
CIF price	2,600
Add : Customs duty @ 40% of CIF	1,040
	<hr/>
(a) Landed cost of imported CKD kit	3,640
	<hr/>

**Estimated cost of locally manufactured
items (60%)**

Cost of locally manufactured items will be 1.5 times of the cost of manufacture by Kozuki. Therefore, cost of manufacture is to be found out as under .

FOB price in local currency (100% CKD)	Rs. 6,000
FOB price in local currency (60% of CKD)	Rs. 3,600
Less : Profit (20% or $\frac{1}{5}$ th of cost or 16.67% or $\frac{1}{6}$ th of sales)	600
	<hr/>
Cost of manufacture by Kozuki	3,000
	<hr/>
(b) Cost of indigenous manufacture (1.5 times of Rs. 3,000)	Rs. 4,500
Cost of standard parts (2.5 of 4,500)	Rs. 1,800
Cost of non-standard parts (3.5 of 4,500)	2,700
(c) Selling price to be fixed for local sales	
Landed cost of imported CKD kit as at (a) above	Rs. 3,640
Cost of indigenous manufacture as at (b) above	4,500
Assembly and other overheads	1,000
Technical know-how (Rs. 30,00,000 ÷ 3,00,000)	10
	<hr/>
Total cost excluding royalty	9,150
Add : Royalty (as per separate working)	685*
	<hr/>

Total cost including royalty	9,835
Profit (20% on sales or 25% on cost)	2,459
Selling price for local market	<u>12,294</u>

***Calculation of royalty**

It is given that (i) royalty be paid @ 10% of selling price fixed *less* landed cost of import kit *less* cost of standard items purchased locally and (ii) selling price for local sale will be equal to cost *plus* 20% profit on selling price or 25% profit on cost

Let the selling price $=x$

Let the royalty $=y$

$$x = (\text{cost} + \text{royalty}) \times 1.25$$

or $(9,150 + y) \times 1.25$

or $x = 11,437.50 + 1.25y$... (i)

$$y = 0.01 (\text{selling price} - (\text{landed cost of import} + \text{cost of standard item}))$$

$$= 0.10 (x - (3,640 + 1,800))$$

or $y = 0.1 x - 544$... (ii)

Multiplying (ii) by 1.25 and solving (i) and (ii) above

$$1.25 y = 0.125 x - 680$$
 ... (iii)

$$1.25 y = x - 11,43,750$$
 ... (iv)

or $0.875 x = 10,757.50$ or $x = \text{Rs. } 12,294 (\text{S.P.})$

Putting the value of x in (iv) above

$$1.25y = 856.5 \quad \text{or } y = \text{Rs. } 685$$

$$\text{Royalty} = \text{Rs. } 685$$

Price quotations from two prospective customers

Problem 13.7. A company had nearly completed a specialised piece of capital equipment when it discovered that its customer had gone out of business. After searches, two other possible customers (E Ltd and P Ltd) for the equipment were found who might be interested subject to certain modifications being carried out.

E Ltd. wanted the equipment to be completed to its original specification and then certain extra features to be added. P Ltd. wanted the equipment in its present condition but without its control mechanism and with certain modifications. The costs of these additions and modifications were :

	E Ltd.	P Ltd.
Direct materials (at cost)	Rs. 1,400	Rs. 350
Direct wages		
Dept A	1 man for 3 weeks	—
Dept B	2 men for 5 weeks	1 man for 3 weeks
Dept C	2 men for 8 weeks	1 man for 5 weeks
Variable overhead	15% of direct wages	15% of direct wages
Special delivery charge	Rs. 1,700	Rs. 450
Fixed production overhead is absorbed as follows :		
Dept A	120% of direct wages	
Dept B	80% of direct wages	
Dept C	40% of direct wages	

The costs of the equipment as originally estimated and incurred so far were :

	<i>Original quotation</i>	<i>Work done so far</i>	<i>Work yet to be done</i>
Direct materials	Rs. 26,150	Rs. 21,490	Rs. 4,685
Direct wages	15,000	13,400	2,100
Overhead—variable	2,250	2,010	315
—fixed production	12,500	10,500	2,400
—fixed selling and administration	2,500	2,100	400
	<u>58,400</u>	<u>49,500</u>	<u>9,900</u>
	=====	=====	=====

The price to the original customer allowed for a profit margin of 20% on selling price. An advance payment of 15% of the price had been received when the order had been confirmed.

The following additional information is related to the possible versions :

1. Direct materials for the additions for E Ltd. would need to be bought from suppliers, but those for modifications for P Ltd. are in stock and, if not used for P Ltd., would be used on another contract in place of materials that would now cost Rs. 750.

2. The wage rate in Dept A is Rs. 140 per man per week. This department is slack at present but, to ensure the availability of skilled personnel, it must keep three men on its payroll even though the current and projected load for the next few months is only 50% of capacity.

3. Dept B is working normally and its wage rate is Rs. 120 per man per week.

4. Dept C is extremely busy. Its wage rate is Rs. 100 per man per week and it is currently yielding a contribution to overhead and profit of Rs. 320 per Rs. 1 of direct labour.

5. If the work for either E Ltd or P Ltd is undertaken, supervising overtime of Rs. 500 and Rs. 350 respectively would be incurred. Such costs are normally charged to fixed production overhead.

6. The cost of the control mechanism that P Ltd. does not require was Rs. 4,500. If taken out (at a cost of 1 man-week's work in Dept B), it could be used on another contract in place of a different mechanism which could be bought for Rs. 3,500.

If neither of the conversions is carried out, some of the materials in the original equipment could be used on another contract in place of materials that would have cost Rs. 4,000, but would need 2 man-weeks of work in Dept B to make them suitable. The remaining materials would realise Rs. 3,800 as scrap. The drawings for the equipment, which would normally be included in the selling price, could be sold for Rs. 500.

You are required to calculate :

(a) the minimum price that the company should accept from P Ltd for the converted machine ,

(b) the minimum price at which it would be more advantageous to sell to E Ltd if the company received an offer from P Ltd of Rs. 18,000 for the converted machine.

Explain clearly how you reach your recommended figure.

(I.C.M.A., London, May 1984 Adapted)

Solution.

Working Notes :

1. Cost of completing equipment for E Ltd and adding certain extra features.

For Work still to be done :

Direct material	Rs. 4,685	
Direct wages	Rs. 2,100	
Variable overhead	Rs. 315	
	<hr/>	7,100

For Extra Features :

Direct materials	Rs. 1,400
Direct wage	
Deptt A :	
3 man-weeks @ Rs. 120	--
(Refer to Note 1)	
Deptt B	
10 man-weeks @ Rs. 120	Rs. 1,200

Deptt C

16 man-weeks @ Rs. 420

(Refer to Note 2)

Rs. 6,720

7,920**Variable Overhead :**

15% of (Rs. 7,920 + Rs. 420 for A Deptt)

1,251

(Refer to Note 3)

Supervisory overtime

500

Special delivery

1,70012,771

Total cost to complete with extra features

19,871

2. Cost to modify equipment for P Ltd. with cost of removing control mechanism not required by P Ltd.

Modifications :

Direct material

Rs. 750

(Refer to Note 4)

Direct wages :

Deptt B

3 man-weeks @ Rs. 120

Rs. 360

Deptt C

5 man-weeks @ Rs. 420

Rs. 2,100

2,460

Variable overhead

15% of Rs. 2,460

369

Special delivery

450

Supervisory overtime

3504,379

Credit for control mechanism

(Refer to Note 5)

3,500

Less : Cost of removal

1 man-week @ Rs. 120

Rs. 120

15% variable overhead

181383,362

Cost to modify after allowing deduction for control mechanism

1,017

3. Cost of Dismantling or scrap equipment

Material recovered		Rs. 4,000	
Less : Deptt B's cost			
2 man-weeks @ Rs. 120	240		
15% overhead on Rs. 240	36		
	<u>276</u>		
			3,724
Material sold as scrap			3,800
Sale of drawings			500
			<u>8,024</u>

(a) Minimum prices that company should accept from P Ltd. for the converted machine

Total cost to modify	
Less : Cost of control mechanism	Rs. 1,017
Add : Residual value if dismantled	8,024
	<u>9,041</u>
Minimum price for P Ltd.	<u><u>9,041</u></u>

Other considerations :

Besides, some cost should be added for organising the modifications/re-arranging the scheduling, extra transport etc. If this price is not accepted, employees in A Department will be idle. It is not good for morale of the employees. It is recommended that something say Rs. 200 should be added to above cost before quoting to P Ltd, i.e., quotation to P Ltd. should be for Rs. 9,250.

(b) Minimum price at which it would be advantageous to sell to P Ltd. if the company received an offer instead of selling to P Ltd. for Rs. 18,000.

Sale price from P Ltd	Rs. 18,000
Less : Extra cost for P Ltd.	1,017
	<u>16,983</u>
Profit on sale to P Ltd	16,983
Cost to complete for E Ltd	19,871
(Refer to Working Note 1)	
	<u>36,854</u>
Minimum price for E Ltd	<u><u>36,854</u></u>

Other considerations : This is the basic price. It should be increased by say Rs. 500 (this increase has to be more than the increase in 'a') for re-scheduling drawings and disruption of work etc.

∴ Price to be quoted to E Ltd should be Rs. 37,350.

Working Notes. 1. Since Department A is not operating at 100% capacity, its cost should not be considered for this purpose and should be treated like fixed cost for pricing purpose. This cost will have to be

incurred whether or not this decision is taken. Therefore, this cost should not be considered for this decision.

2. Rs. 100 + Rs. 120 for contribution lost.

3. Variable overhead should be charged for Deptt. A as well.

4. Value to business for this material is Rs. 350 but in this case opportunity cost of this material should be considered.

5. Value to the business is Rs. 4,500 but it can fetch only Rs. 3,500. Therefore credit should be given only for Rs. 3,500 in price considerations.

Contribution approach to pricing—ROCE

***Problem 13-8.** Look Ahead Ltd. wants to fix proper selling prices for their products 'A' and 'B' which they are newly introducing in the market. Both these products will be manufactured in Department D which is considered as a Profit Centre.

The estimated data are as under :

	A	B
Annual Production (units)	1,00,000	2,00,000
	Rs.	Rs.
Direct Materials per unit	15'00	14'00
Direct Labour per unit (Direct Labour Hour Rate = Rs. 3)	9'00	6'00

The proportion of overheads other than interest, chargeable to the two products are as under :

Factory overheads (50% fixed) 100% of Direct Wages, Administration overheads (100% fixed) 10% of factory costs. Selling and Distribution overheads (50% variable) Rs. 3 and Rs. 4 respectively per unit of products A and B.

The fixed capital investment in the Department is Rs. 50 lakhs. The working capital requirement is equivalent to 6 months stock of cost of sales of both the product. For this project a term loan amounting to Rs. 40 lakhs has been obtained from Financial Institutions at an interest rate of 14% per annum. 50% of the working capital needs are met by Bank borrowings carrying interest at 18% per annum. The Department is expected to give a return of 20% on capital employed.

You are required to :

(a) Fix the selling price of products A and B such that the contribution per direct labour hour is the same for both the products.

(b) Prepare a statement showing in detail the overall profit that would be made by the Department.
(C.A. Final, Nov. 1984)

Solution :**(i) Statement showing Total Cost per unit and Variable Cost per unit :**

	<i>Product A</i>		<i>Product B</i>	
	<i>Total cost per unit</i>	<i>Variable cost per unit</i>	<i>Total cost per unit</i>	<i>Variable cost per unit</i>
Direct Material	15·00	15·00	14·00	14·00
Direct Labour	9·00	9·00	6·00	6·00
Factory Overhead	9·00	4·50	6·00	3·00
Total Factory Cost	33·00	28·50	26·00	23·00
Admn. Overhead	3·30	—	2·60	—
Selling & Dist. Overhead	3·00	1·50	4·00	2·00
Cost of Sales	39·30	30·00	32·60	25·00

(ii) Statement showing Total Cost and Variable Cost :

	<i>Units No.</i>	<i>Variable cost Rs.</i>	<i>Total cost Rs.</i>
Product A	1,00,000	30,00,000	39,30,000
Product B	2,00,000	50,00,000	65,20,000
Total		80,00,000	104,50,000

(iii) Statement showing Capital employed and expected return :

Fixed Capital Investment	Rs. 50,00,000
Working Capital (6 months cost of sales, i.e., $\frac{1}{2}$ of 104,50,000)	52,25,000
	102,25,000

Expected return (20% of capital employed)	20,45,000
-------------------------------------------	-----------

(iv) Sales value and contribution :

Total Cost	104,50,000
Add : Return	20,45,000
Sales Value	124,95,000
Less : Variable Cost	80,00,000
Contribution	44,95,000

(v) Total Labour Hours :

A	$1,00,000 \times 3 = 3,00,000$
B	$2,00,000 \times 2 = 4,00,000$
	<u>7,00,000</u>

(vi) Contribution per labour hour :

$$= \frac{44,95,000}{7,00,000} \text{ or } 6.4214.$$

(vii) Determination of selling price

	A	B
Variable cost	30.0000	25.0000
	19.2642	12.8428
Contribution	<u>49.2642</u>	<u>37.8428</u>

(viii) Statement showing in detail the overall profit of the Department :

	Products		
	A	B	Total
Sales (units)	<u>1,00,000</u>	<u>2,00,000</u>	
Sales Value	Rs. 49,26,430	Rs. 75,68,570	Rs. 1,24,95,000
Less : Variable cost	<u>30,00,000</u>	<u>50,00,000</u>	<u>80,00,000</u>
Contribution (A)	<u>19,26,430</u>	<u>25,68,570</u>	<u>44,95,000</u>
Less : Fixed Cost :			
Fixed overhead	4,50,000	6,00,000	10,50,000
Adm. Overhead	3,30,000	5,20,000	8,50,000
Selling & Dist. Overhead	1,50,000	4,00,000	5,50,000
Interest on term loan @ 14%			5,60,000
Interest on working capital (18% on 50% of working capital) i.e., 52,25,000			<u>4,70,250</u>
Total Fixed Cost (B)			<u>34,80,250</u>
Profit (A—B)			<u>10,14,750</u>

Return on sales/capital employed before and after revaluation adjustments

Problem 13.9. The following are the financial data for the past year of two subsidiary companies A Ltd. and B Ltd.

	A Ltd. (Rs. '000)	B Ltd. (Rs. '000)
Sales	11,760	11,040
Depreciation	2,240	1,600
Other Costs	6,400	5,120
Fixed Assets at cost	22,400	19,200
Accumulated Depreciation	15,680	6,400
Working Capital	2,560	1,600

Depreciation is calculated by the straight line method.

Holding company assesses managerial performance on the Return on Capital Employed (ROCE). For a management review, it has been decided that fixed assets should be revalued at replacement and using the prices indices, assuming cost at 100 :

A Ltd.	160
B Ltd.	120

In addition the following adjustments are to be made to B Ltd's results to equate with the treatment given by A Ltd.

(i) A Ltd. bought a Computer last year for Rs. 11,20,000 (seven year life) but B Ltd. leased identical Computer at an annual rental of Rs. 1,92,000.

(ii) A Ltd. spent Rs. 1,60,000 on a plant overhaul which B Ltd. would not require at least three years.

(iii) A Ltd. and B Ltd. both spent Rs. 4,80,000 on advertising. A Ltd. charged all to last year's accounts but B Ltd. carried forward 50% to the current year.

(iv) A Ltd. and B Ltd. both spent Rs. 3,20,000 in each of the past two years on research ; A Ltd. charged each year's expense as incurred but B Ltd. spread charge equally over four years.

As the management accountant, you are required to :

(a) Calculate and compare the initial return of the two companies, analysing difference due to profitability on sales and intensity of asset use.

(b) Calculate the results of both companies after revaluing fixed assets and adjusting B Ltd.'s figures for the other factors given, commenting briefly on the results.

(I.C.W.A. Final, June 1986)

Ignore taxation

Solution.**(a) Statement showing initial returns of A Ltd. and B Ltd.**

	(Rs. '000)	
	<i>A Ltd.</i>	<i>B Ltd.</i>
Sales	11,760	11,040
Less : Depreciation 2,240		1,600
Other costs 6,400	8,640	5,120
	<u>3,120</u>	<u>6,720</u>
Profit	<u>3,120</u>	<u>4,320</u>
Capital employed		
Fixed Assets 22,400		19,200
Less : accumulated depreciation 15,680		6,400
	<u>6,720</u>	<u>12,800</u>
Net fixed assets	6,720	12,800
Working capital	2,560	1,600
	<u>9,280</u>	<u>14,400</u>
Total capital employed	<u>9,280</u>	<u>14,400</u>

- (i) Return on capital employed : *A Ltd.* *B Ltd.*
 Profit/C.E. $3,120/9,280$ or 33·62% $4,320/14,400$ or 30%
- (ii) Profit/sales $3,120/11,760$ or 26·53% $4,320/11,040$ or 39·13%
- (iii) Sales/C.E. $11,760/9,280$ or 1·267 times $11,040/14,400$
 or 0·767 times

Comments : 1. Return on capital employed of *A Ltd.* is higher than *B Ltd.* by nearly 4%

2. *A Ltd.* is more efficient than *B Ltd.* as its intensity of capital use is higher than the other company.

3. The superiority of *A Ltd.* as indicated at 1 and 2 above is slightly offset by lower profitability (26·53%) as against *B Ltd.* (39·13%)

(b) Statement showing revised return after revaluation and adjustments

	(Rs. '000)	
	<i>A Ltd.</i>	<i>B Ltd.</i>
Revaluation Adjustments		
Capital employed		
Fixed Assets $22,400 \times 1·6$	= 35,840	$19,200 \times 1·2$ 23,040
Less : Accum. Depreciation $15,680 \times 1·6$	<u>25,088</u>	<u>6,400 \times 1·2</u> 7,680

USE OF COSTS IN PRICING DECISIONS

P13·25

Net fixed assets	10,752		15,360
Working capital	2,560		1,600
	<u> </u>		<u> </u>
Revised capital employed	13,312	(A)	16,960
	<u>==</u>		<u>==</u>
Profit			
Profit before revaluation	3,120		4,320
Less : Extra depreciation due to revaluation (Revised indices minus original) $2,240 \times (1.6 - 1)$	1,344	$1,600 \times (1.2 - 1)$	320
	<u> </u>		<u> </u>
Revised profit	1,776	(B)	4,000
	<u>==</u>		<u>==</u>

Other adjustments for B Ltd only

	Impact on C.E	Impact	
(i) Rental	1,120	192	
Less : Depreciation $(1,120 \div 7)$	160	160	
	<u> </u>	<u> </u>	+ 32
		+960	
(ii) Plant overhaul		160	+160
(iii) Advertisement	480	480	•
Less : 50% charged to current year	240	-240 240	
	<u> </u>		-240
(iv) Research	Actual	Budgeted	Actual Budgeted
For last year but one	(240)	—	(80) (320)
For last year	$(240 + 160)$	—	$(80 + 80)$ 320 (240)
		<u> </u>	<u> </u> (240)
Total (i) to (iv)		+320	—
Add : Value at (A) and (B)		+169·0	4,000
		<u> </u>	<u> </u>
Revised capital employed and profit	17,280		3472
	<u>==</u>		<u>==</u>

Calculation of returns

A. Ltd.

B. Ltd.

New Return on C.E.

= Revised Profit/Revised

Capital Employed $1,776/13,312$ or 13·34% $3,472/17,280$ or 20·09%

Revised Profit/sales $1,776/11,760$ or 15·10% $3,472/11,040$ or 31·45%

Sales/Revised C.E. $11,760/13,312$ or 0·883 times $11,040/17,280$ or 0·639 times

Comments :

1. There is a drop in ROI for both the companies. Return has come down by 20% for A Ltd. and by 10% for B. Ltd.

2. Intensity of capital use has come down for both the companies.
3. Revised profit as a percentage of sales has also shown a declining trend.
4. First two ratios are better in case of *B* Ltd. as compared to *A* Ltd.

Uniform cost-based fair price

Problem 13·10. (a) What according to you should be the basic principles for fixation of the controlled price for a product ?

(b) The share of total production and the cost-based fair price computed separately for each of the four units in industry are as follows :

	Rs. per unit			
	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>
Share of Production	40%	25%	20%	15%
Material Costs	15	18	17	19
Direct Labour	10	12	14	16
Depreciation	30	20	16	10
Other Overheads	30	30	28	24
	<hr/>	<hr/>	<hr/>	<hr/>
	85	80	75	69
20 per cent return on Capital Employed	63	43	35	23
Fair Price	<hr/>	<hr/>	<hr/>	<hr/>
	148	123	110	92
Capital employed per unit is worked out as follows :				
Net Fixed Assets	300	200	160	100
Working Capital	14	15	15	15
	<hr/>	<hr/>	<hr/>	<hr/>
Total	314	215	175	115
	<hr/>	<hr/>	<hr/>	<hr/>

Indicate, with reasons, what should be the uniform price fixed for the product. (ICWA Final, December 1985)

Solution. (a) Please refer to Advanced Cost Accounting now titled Advance Cost and Management Accounting—Text by Saxena and Vashist

(b) Suppose the total production is 100 units. The uniform price fixed for the product will be as under :

Industry's units	Total cost Rs.	Return Rs.	Sales Value Rs.
<i>A</i>	$40 \times 85 = 3,400$	$40 \times 63 = 2,520$	$40 \times 148 = 5,920$
<i>B</i>	$25 \times 80 = 2,000$	$25 \times 43 = 1,075$	$25 \times 123 = 3,075$
<i>C</i>	$20 \times 75 = 1,500$	$20 \times 35 = 700$	$20 \times 110 = 2,200$
<i>D</i>	$15 \times 69 = 1,035$	$15 \times 23 = 345$	$15 \times 92 = 1,380$
	<hr/>	<hr/>	<hr/>
Total	7,935	4,640	12,575
	<hr/>	<hr/>	<hr/>

Uniform price Rs. $12,575 \div 100 = \text{Rs. } 125.75$ for each unit. In the above case, 20% return on capital employed has been used for pricing purpose. Working capital is almost equal for all the units. There are larger variations in net fixed assets of these units. It would have been more prudent to use the concept "Return on Net worth" if it is possible to find the net worth for these units.

INTER-DIVISION TRANSFER PRICING

Transfer Pricing at different capacity levels

***Problem 13-11.** P.H. Ltd. has two manufacturing departments organised into separate profit centres known as the Basic unit and Processing unit. The basic unit has a production capacity of 4,000 tonnes per month of Chemvax but at present its sales are limited to 2,000 tonnes to outside market and 1,200 tonnes to the processing unit.

The transfer price for the year 1986 was agreed at Rs. 400 per tonne. This price has been fixed in line with the external wholesale trade price on 1st January 1986. However due to heavy competition the basic unit has been forced to reduce the wholesale trade price to Rs. 360 per tonne with effect from 1st June 1986. This price however was not made applicable to the sales made to the processing unit of the company. The processing unit applied for revision of the price as applicable to the outside market buyers as from 1st June 1986 but the same was turned down by the basic unit.

The processing unit refines Chemvax and packs the output known as Colour-X in drums of 50 kgs each. The selling price of Colour-X is Rs. 40 per drum. The processing unit has a potential of selling a further quantity of 16,000 drums of Colour-X provided the overall price is reduced to Rs. 32 per drum. In that event it can buy the additional 800 tonnes of Chemvax from the basic unit whose capacity can be fully utilised. The outside market will not however absorb more than the present quantity of 2,000 tonnes.

The cost data relevant to the operations are :

	Basic unit	Processing unit
	Rs.	Rs.
Raw Materials/tonne	70	Transfer price
Variable Costs/tonne	140	170
Fixed costs/month	Rs. 3,00,000	1,20,000

Required :

(i) Prepare statements showing the estimated profitability for June 1986 for each unit and the company as a whole on the following bases :

(a) At 80% and 100% capacity utilisation of the basic unit at the market price and transfer price to the processing unit of Rs. 400 per tonne.

(b) At 80% capacity utilisation of the basic unit at the market price of Rs. 360 per tonne and the transfer price to the processing unit of Rs. 400 per tonne.

(c) At 100% capacity utilisation of the basic unit at the market price and transfer price to the processing unit of Rs. 360 per tonne.

(ii) Comment on the effect of the company's transfer pricing policy on the profitability of the processing unit. (I.C.W.A. Final, Dec. 1986)

Solution.

(a)

Manufacturing Departments

		Basic Unit	Processing Unit
Production at 100% capacity p.m.		4,000 tonnes	2,000 tonnes
Marketing limiting factor		2,000	
Processing Unit		1,200*	
80% Capacity (Basic unit)		3,200 tonnes	1,200*
All 100% capacity (Rs. 400/Tonne)			
(i) Sales		2,000 te ÷ 50 kg	
(4,000 × Rs. 400)	16,00,000	40,000 drums × Rs. 32	12,80,000
(ii) Less Costs :			
Raw Material			
4,000 × Rs. 70	2,80,000	2,000 × Rs. 400	8,00,000
Variable cost			
(4,000 × 140)	5,60,000	2,000 × 170	3,40,000
Fixed costs	3,00,000		1,20,000
Total	11,40,000		12,60,000
Profit (i - ii)	4,60,000		20,000
Profit for the company Rs. 4,60,000 + 20,000 = Rs. 4,80,000.			

At 80% capacity (Rs. 400/tonne)

(i) Sales		1,200 te ÷ 50 kg	
(3,200 × Rs. 400)	12,80,000	24,000 drums × 40	9,60,000
(ii) Less Costs :			
Raw materials			
(3,200 × 70)	2,24,000	1,200 × 400	4,80,000
Variable costs			
(3,200 × 140)	4,48,000	1,200 × 170	2,04,000

Fixed costs	3,00,000	1,20,000
	<u>9,72,000</u>	<u>8,04,000</u>
Profit (i—ii)	3,08,000	1,56,000
Total profit (Rs. 3,08,000+1,56,000)		<u>4,64,000</u>

(b) 80% capacity (market price Rs. 360/tonne and transfer price at Rs. 400/tonne)

	Basic unit		Processing unit
(i) Sale		1,200 te ÷ 50	
(2,000 × 360)	Rs. 7,20,000	24,000 × 40	9,60,000
(1,200 × 400)	4,80,000		
	<u>12,00,000</u>		<u>9,60,000</u>
(ii) Less Costs :			
Raw materials			•
(3,200 × 70)	2,24,000	1,200 × Rs. 400	4,80,000
Variable costs			
(3,200 × 140)	4,48,000	1,200 × Rs. 170	2,04,000
Fixed overheads	3,00,000		1,20,000
	<u>9,72,000</u>		<u>8,04,000</u>
Profit (i— ii)	2,28,000		1,56,000

Total profit (Rs. 2,28,000+1,56,000)=3,84,000

(c) 100% capacity (Rs. 360—market and transfer price) :

(i) Sales		2000 te ÷ 50	
(4,000 × Rs. 360)	14,40,000	40,000 × Rs. 32	12,80,000
(ii) Raw Material			
(4,000 × Rs. 70)	2,80,000	2,000 × Rs. 360	7,20,000
Variable overheads			
(4,000 × 140)	5,60,000	2,000 × 170	3,40,000
Fixed overheads	3,00,000		1,20,000
	<u>11,40,000</u>		<u>11,80,000</u>
Profit (i — ii)	3,00,000		1,00,000

Total profit (Rs. 3,00,000+1,00,000)= Rs. 4,00,000.

(ii) Comments on profitability of the processing unit :

The profitability of processing unit is summarised below.

<i>Alternative</i>	<i>Transfer price</i>	<i>Profit</i>
(a) (i) 80% capacity	Rs. 400	Rs. 1,56,000
(ii) 100% capacity	Rs. 400	Rs. 20,000
(b) 80% capacity	Rs. 400	Rs. 1,56,000
(c) 100% capacity	Rs. 360	Rs. 1,00,000

The processing unit will not be interested to buy more than 1,200 tonnes from basic unit. At 80% capacity the profit is Rs. 1,56,000. If it buys more than 1,200 tonnes at Rs. 400/drum its profitability is reduced to Rs. 20,000.

Even if the price is reduced to Rs. 360, processing unit may not be able to buy more than 1,200 tonnes as profit is reduced to Rs. 1,00,000.

The present policy of the management is not at all attractive to the processing unit.

Cost-plus inter-division transfer prices

Problem 13.12. Your company fixes the inter-divisional transfer prices for its products on the basis of cost, plus a return on investment in the division. The Budget for Division A for 1981-82 appears as under :

Investment in Division A

	Rs.
Fixed Assets	5,00,000
Current Assets	3,00,000
Debtors	2,00,000
Annual Fixed Cost of the Division	8,00,000
Variable Cost per unit of Product	10
Budgeted Volume	4,00,000 units per year
Desired ROI	28%

Determine the transfer Price for Division A.

(I.C.W.A. Final, June 1981)

Solution. The desired rate of return is 28% on investments
Investments include :

- (i) Fixed assets after depreciation
- (ii) Net working capital.

In the question, current assets and debtors are given but current liabilities and creditors are not indicated. Therefore, these are assumed to have nil value.

<i>Investments</i>		Rs.
Fixed assets		5,00,000
Net working capital	Rs.	
Current assets	3,00,000	
Debtors	2,00,000	5,00,000
Total investments		10,00,000

The desired rate of return is 28%

∴ The profit margin will be

$$= \text{Rs. } 10,00,000 \times \frac{28}{100}$$

$$= \text{Rs. } 2,80,000$$

Budgeted volume = 4,00,000 units

Profit margin per unit = Re. 0.70

Fixed Cost per unit

(Rs. 8,00,000 ÷ 4,00,000 units) Rs. 2.00

Variable Cost per unit Rs. 10.00

Transfer Price per unit Rs. 12.70

Buying from Group-Companies or from outside

Problem 13'13. Companies GP, GR, GS and GI are members of a group. GP wishes to buy an electronic control system for its factory and in accordance with group policy, must obtain quotations from companies inside and outside the group.

From outside of the group the following quotations are received :

Company A quoted Rs. 33,200.

Company B quoted Rs. 35,000 but would buy a special unit from GS for Rs. 13,000. To make this unit, however, GS would need to buy parts from GR at a price of Rs. 7,500.

The inside quotation was from GS whose price was Rs. 48,000. This would require GS buying parts from GR at a price of Rs. 8,000 and units from GT at a price of Rs. 30,000. However, GT would need to buy parts from GR at a price of Rs. 11,000.

Additional data are as follows :

GR is extremely busy with work outside the group and has quoted current market prices for all its products.

GS costs for the GP contracts, including purchases from GR and GT total Rs. 42,000. For the company B contract it expects a profit of 25% on the cost of its own work.

GT prices provide for a 20% profit margin on total costs.

The variable costs of the group companies in respect of the work under consideration are :

GR—20% of selling price.

GS—70% of own cost (excluding purchases from other group companies)

GT—65% of own cost (excluding purchases from other group companies).

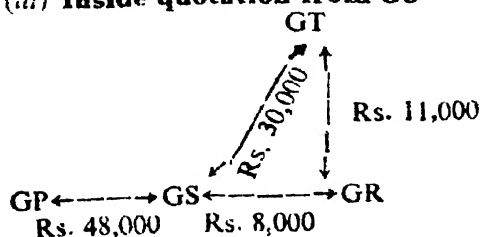
You are required, from group point of view, to recommend, with appropriate calculations, whether the contract should be placed with GS or Company A or Company B. (I.C.W.A. Final, June 1986—RS)

Solution It is given that GP wishes to buy an electronic control system. It must obtain quotations from companies inside and outside the group. It is required to evaluate the quotations both from outside companies, viz., Company A and Company B ; and inside company viz., GS.

Evaluation of quotations from outside companies viz., company A and company B

(i) Company A's quotation	Rs. 33,200
(ii) Company B's quotation (It will buy special unit from GS)	Rs. 35,000
Less : Value of GS subcontract work	13,000
Cost of executing external contract	22,000
Add : Price of GR subcontract	7,500
	<u>29,500</u>
Add : Variable cost of GS subcontract work : Rs. 13,000 - 7,500	= 5,500
Less : Profit 25% of cost or 20% of selling price	= 1,100
Total cost	4,400
Variable cost (70% of Rs. 4,400)	3,080
Group net incremental cost of B	<u>32,580</u>

(iii) Inside quotation from GS



Quotation from GS at a price of Rs. 48,000

Or

Against price of Rs. 48,000, cost to GS is Rs. 42,000
Total costs of GS quotation

Less: Value of sub-contract work :

GR	Rs. 8,000	
GT	30,000	38,000
		<u>4,000</u>
Total cost of work done by GS		Rs. 2,800
Variable cost (70% of Rs. 4,000)		

Add : Market value of GR Work :

Direct to GS 8,000

Work done through GT 11,000

19,000

Add : Variable cost of GT sub-contract work :

Rs. 30,000—11,000 =Rs. 19,000

Less : Profit (20% of cost or 16.67% or $\frac{1}{6}$ of value)

($\frac{1}{6} \times$ Rs. 30,000) 5,000

Total cost of GT work 14,000

Variable cost (65% of Rs. 14,000) 9,100

Group net incremental cost of GS quotation

30,900

GS quotation (net incremental cost) is the minimum. Therefore order should be awarded to GS.

Effect on profit of alternative transfer pricing

Problem 13.14. Transferor Ltd. have two processes—Preparing and Finishing. The normal output per week is 7,500 units (completed) at a capacity of 75%.

Transferee Ltd. had production problems in preparing and require 2,000 units per week of prepared material for their finishing processes.

The existing cost structure of one prepared unit of Transferor Ltd. at existing capacity :

Material Rs. 2.00 (variable 100%)

Labour Rs. 2.00 (variable 50%)

Overhead Rs. 4.00 (variable 25%)

The sale price of a completed unit of Transferor Ltd. is Rs. 16 with a profit of Rs. 4 per unit.

Contrast the effect on the profits of Transferor Ltd. for six months (25 weeks) of supplying units to Transferee Ltd. with the following alternative transfer prices per unit :

(i) Marginal Cost :

(ii) Marginal Cost+25%

(iii) Marginal Cost+15% Return on capital (assume capital employed Rs. 20 Lakh) ;

(iv) Existing Cost ;

(v) Existing Cost+ a portion of profit on the basis of :

$$\frac{\text{Preparing Cost}}{\text{Total Cost}} \times \text{Unit Profit}$$

(vi) At an agreed market price of Rs. 8.50.

Assume no increase in fixed cost. (I.C.W.A. Final, June '86)

Solution. The existing normal output of Transferor Ltd. is 7,500 units per week or 1,87,500 units for six months (25 weeks). The rate of profit is Rs. 4 per unit. Thus, the total profit for six months will be Rs. 7,50,000, i.e., $(1,87,500 \times \text{Rs. } 4)$. It is noticed that there is no increase in fixed cost at all. The impact on profit under various alternative is as follows :

(i) Marginal cost : The marginal cost per unit is material Rs. 2 + Labour Re. 1 + Variable overhead Re. 1 = Rs. 4. If output is transferred to Transferee Ltd. at Rs. 4, there is no change in the profit earned by Transferor Ltd.

(ii) Marginal cost + 25% = Rs. 4 + 25% of 4 = Rs. 5

Extra profit = Rs. 5 - 4 = Re. 1 per unit

No. of units required by Transferee Ltd. = 2,000 units per week
or 50,000 units in 25 weeks

Extra profit earned = 50,000 × Re. 1 = Rs. 50,000.

(iii) Marginal cost + 15% Return on capital
= Rs. 4 + 15% p.a. of Rs. 20 lakhs

Extra profit = $\frac{15}{100} \times 20,00,000 \times \frac{6}{12}$ = Rs. 1,50,000

(iv) Existing cost : Existing marginal cost = Rs. 4.
Existing cost (Fixed* + Variable) = Rs. 8

Existing profit = Rs. 4

At existing cost, the profit per unit = Rs. 4

Profit for 50,000 units = 50,000 × 4 = Rs. 2,00,000

(v) Existing cost + portion of profit on the basis of :

$\frac{\text{Preparing cost}}{\text{Total Cost}} \times \text{Unit profit} = \frac{8}{12} \times 4 = \text{Rs. } 2.67$

Existing cost Rs. 8 + 2.67 profit = Rs. 10.67

Existing marginal cost = 4.00

6.67

(vi) Existing cost = Existing profit = Rs. 4

Extra profit = 50,000 × Rs. 6.67 = Rs. 3,33,500

(vi) Agreed market price = Rs. 8.50

Less : Marginal cost 4.00

Extra profit per unit 4.50

Total profit 50,000 × 4.50 = Rs. 2,25,000

*Excluding selling and distribution overheads which are directly not given in the question

Contrast the effect on the profit of Transferor Ltd.

<i>Alternative</i>	<i>Effect on profit</i>
(i)	Nil
(ii)	Rs 50,000
(iii)	1,50,000
(iv)	2,00,000
(v)	3,33,000
(vi)	2,25,000

Alternative (v) gives the maximum profit to Transferor Ltd.

Contribution approach to transfer pricing

Problem 13.15. Fastners Ltd. is having production shops reckoned as cost centres. Each shop charges other shops for material supplied and services rendered.

The shops are motivated through goal congruence, autonomy and management efforts. Fastner Limited is having a welding shop and painting shop. The welding shop welds annually 75,000 purchased items with other 1,50,000 shop made parts into 12,000 assemblies. The assemblies are having total cost of Rs. 9.50 each and are sold in market at Rs. 12 per assembly. Out of the total production, 80% is diverted to painting shop at same price ruling in the market. Welding shop incurs a fixed cost of Rs. 25,000 per annum. The painting shop is having fixed cost of Rs. 30,000 and its cost of painting including transfer price from welding shop comes to Rs. 20 per unit. This shop sells all units transferred to it by welding shop at Rs. 25 per assembly.

You are required to :

(a) Find out profit of individual cost centre and overall profitability of the concern.

(b) Recommend course of action if painting shop wishes to purchase its full requirement (at market price which is Rs. 10 per assembly) either from open market or from welding shop at market price of Rs. 10 per assembly.

Give reasons for your recommendations. (I.C.W.A. Final, June 1985)

Solution.

Fastner Limited

(a) Present profitability of individual shops and overall profitability

<i>Particulars</i>	<i>Welding shop</i>			<i>Painting shop</i>		
	<i>Qty.</i>	<i>Rate</i>	<i>Value</i>	<i>Qty.</i>	<i>Rate</i>	<i>Value</i>
	units	Rs.	Rs.	units	Rs.	Rs.
Sale in open market	2,400	12.00	28,800	9,600	25.00	2,40,000
Transfer to paint shop	9,600	12.00	1,15,200			

Total sales	12,000	1,44,000	9,600	2,40,000
Less : Variable cost (12,000 × 9.50)		1,14,000	(9,600 × 20)	1,92,000
Contribution		30,000		48,000
Less : Fixed cost		25,000		30,000
Profit		5,000		18,000

Overall profit for the company (5000 + 18,000) = Rs. 23,000

(b) (i) When painting shop purchases all its requirement from open market at a price of Rs. 10 per unit :

	Welding shop			Painting shop		
	Qty. unit.	Rate Rs.	Value Rs.	Qty. units	Rate Rs.	Value Rs.
Sales	2,400	12.00	28,800	9,600	25.00	2,40,000
Less : Variable cost	2,400	9.50	22,800	9,600	18.00*	1,72,800
Contribution			6,000			67,200
Less : Fixed cost			25,000			30,000
Profit/(Loss)			(19,000)			37,200

Overall profit for the company

37,200 - 19,000 = Rs. 18,200

*It is given in the question that cost of painting including transfer price from welding shop at Rs. 20 per unit. The transfer price from welding shop is Rs. 12 per unit. Therefore, the variable cost of Rs. 8 (Rs. 20 - 12) is incurred by painting shop exclusively. The painting shop will be purchasing its requirement from open market at Rs. 10 per unit. Therefore, the variable cost per unit in painting shop will be Rs. 18 (Rs. 10 + 8). This point should be noted carefully.

(b) (i) When all the requirements of painting shop is met by transfer from welding shop at a transfer price of Rs. 10 per unit.

	Welding shop			Painting shop		
	Qty.	Rate	Value	Qty.	Rate	Value
Sale in the open market	2,400	12.00	28,800	9,600	25.00	2,40,000
Transfer to painting shop	9,600	10.00	96,000			
Total sales	12,000		1,24,800			

<i>Less</i> : Variable cost	(12,000 × 9.50)	1,14,000	(9,600 × 18)	1,72,800
Contribution		10,800		67,200
<i>Less</i> : Fixed cost		25,000		30,000
Profit/(Loss)		(14,200)		37,200
		===		===

Overall profit of the company = 37,200 — 14,200 = Rs. 23,000

For the purpose of comparison, the results of the three alternatives are summarised below :

	<i>Welding shop</i>	<i>Painting shop</i>
Profit under (i)	Rs. 5,000	Rs. 18,000
Profit/(Loss) under (b) (i)	(19,000)	37,200
Profit/(Loss) under (b) (ii)	(14,200)	37,200
The overall profit under (i)	= Rs. 23,000	
b(i)	18,200	
b(ii)	23,000	

Alternative (b) (ii) should be accepted due to the following reasons :

(a) It gives a maximum overall profit of Rs. 23,000.

The discussion is confined to either b(i) or b(ii).

(b) Each shop is treated as a separate cost centre and not a profit centre.

(c) The policy of overall goal congruence of the company is followed.

Alternative choices of purchasing equipments—Departments considered as profit centres

Problem 13.16. You are the management accountant of Zeta Ltd. with several production departments functioning as profit centres. Each Manager of the Departments is fully authorised to decide on matters of sale of the products and services of his Department.

Department A purchases a component C from Department B. Department B has fixed the price of C at Rs. 40 per unit with effect from 1st January 1985, while Department A proposes to purchase the component C at Rs. 35 from the market. Department A requires 30,000 units annually. The cost of Department B for producing 'C' is Rs. 30 variable cost per unit and Rs. 6 fixed cost per unit. Manager of Department B has approached the Managing Director to ask Department A to have their requirements produced from his Department, the cost increase is due to installation of a new machinery utilized to make C resulting in higher depreciation. If Department A does not purchase from Department B then the latter can utilise the facilities to alternative use resulting in an annual saving of Rs. 1,25,000.

You are required to comment on :

(i) Will the company benefit as a whole if Department A purchases the component C from the market instead of from Department B ?

(a) If alternative use for the facilities of Department B exists.

(b) If such use does not exist.

(ii) The consequences of alternatives open to Department A.

(iii) How would the Managing Director react bearing in mind the objectives of transfer pricing and decentralised functioning of Departments ?
(I.C.W.A. Final, June '85 R.S.)

Solution. (i) (a) Benefit to the company as a whole if alternative use of facilities exists

A purchases the component from market (30,000 × Rs. 35)	= Rs. 10,50,000
Less : Annual saving by Deptt B by utilising the facilities for alternative use	1,25,000
Cost net of saving	9,25,000
Cost of Deptt B for producing the component (30,000 × Rs. 36)	10,80,000
Net benefit to the company as a whole	1,55,000

(b) If alternative use of facilities does not exist

Purchase price (Rs. 30,000 × Rs. 35)	Rs. 10,50,000
Add : Unabsorbed fixed cost (30,000 × Rs. 6)	1,80,000
Total cost	12,30,000
Less : Cost to manufacture the component (30,000 × Rs. 36)	10,80,000
Loss to the company as a whole	1,50,000

(ii) The consequences of alternatives open to Deptt A

Impact of decision on

Option to Deptt A	Deptt A	Deptt B
	Rs. 40—3)=5	
(a) To purchase from the open market	profit per unit 30,000 × 5 Rs. 1,50,000 profit to Deptt A	Rs. 1,25,000 if alternative use of facilities exists. Loss of Rs. 1,80,000 (30,000 × Rs. 6) to Deptt B by way of unabsorbed fixed costs if such facility does not exist.

(b) To purchase from Deptt B	The profit of Rs. 1.50.000 will turn into loss	Profit per unit Rs. 40—36=Rs. 4 × 30,000=Rs. 120,000 total profit
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(iii) Please refer to *Advanced Cost Accounting* (now titled *Cost and Management Accounting—Text*) by Saxena and Vashist.

Buying from outside Vs. Inter Division (under utilized capacity conditions)

Problem 13-17. Large Scale Operations Ltd., pursues the policy of permitting each of its Divisions to operate essentially as an independent unit. Division Managers are free to determine their own sources of supply and to set their own prices.

The Manufacturing Division has redesigned many of its products. Consequently it will now need 60,000 units per year of part No 3477. This part number is on the production list of the Components Division who markets it at a price of Rs. 30 a piece. This part requires 2 hours of production time and has a unit material cost of Rs. 8. The Components Division has a productive capacity of 8,00,000 labour hours per year. It is operating at 80% capacity now. Total conversion cost in this Division amount to Rs. 6 per labour hour plus Rs. 17,50,000 per annum.

You are required :

(a) To find out the highest price the Manufacturing Division can afford to pay for part no. 3477.

(b) To find out the lowest price at which the Components Division can afford to sell part no. 3477.

(c) If the two Divisions have negotiated a transfer price of Rs. 27.50 for a unit of part no. 3477 and have entered into one year supply contract with each other, is this arrangement advantageous to each division and in the over-all interest of the company?

(d) If the Manufacturing Division, instead of buying the part from the Components Division, had negotiated with an outside supplier for Rs. 27.50 per unit, will this arrangement be advantageous to each Division and in the over-all interest of the company? (ICWA Final, June, '85)

Solution. (a) The Highest Price Manufacturing Division can afford to pay per unit.

Material cost per unit	Rs. 8'00
Conversion cost (2 hours × Rs. 6)	12'00

Maximum price for part No 3477	20'00
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(b) Lowest price at which Components Division can offered to sell

Material cost	Rs. 8'00
Conversion cost	12'00
Fixed overheads (Rs. 17,50,000 ÷ 8,00,000) × 2	4'38

Lowest price for component 3477	24'38
---------------------------------	-------

(c) The Components Division is at present is working at 80% of the installed capacity, i.e., 8,00,000 labour hours. If 20% capacity is utilized, it can produce 80,000 units with 1,60,000 labour hours. It is not advisable to charge the fixed cost when there is unutilized capacity. The profit for the company as a whole will be :

Selling price per unit	Rs. 27·50
Less : Material and conversion costs	20·00
Profit per unit	7·50
No. of units	60,000
Total profit (60,000 × 7·50)	Rs. 4,50,000

Both the divisions are benefited by this arrangement

(d) If the Manufacturing Division decides to buy from outside supplier at Rs. 27·50 per component, the company as a whole will lose by Rs. 4,50,000. Though the Manufacturing Division will get at the same price at which Components Division is offering, the capacity of the component Division will remain utilized. Even, there will be no saving in fixed cost to the Components Division.

Problem 13·18 (Evaluation of Transfer Prices). A group includes two divisions that trade with each other and with companies outside the group. Division 1 sells three products, X, Y and Z. Its major customer for all products is Division 2, but up to 20,000 kgs of product X can also be sold outside the group at a price of Rs. 32 per kg. though special packaging costs of Re. 1 per kg. are incurred in supplying such orders.

The capacity of Division 1 is 1,50,000 hours per annum. All products are made on the same equipment. The processing times and variable costs for each product are :

Product	Processing time hours per kg.	Variable cost* Rs. per kg.
X	2·5	12
Y	3·0	25
Z	2·0	34·5

*Includes the cost of processing time.

The marketing policy of the Division is to sell a minimum of 12,000 kgs. per annum of each product. Its fixed overhead is Rs. 3,00,000 per annum.

Division 2 sells four products, L, M, N and P to customers outside the group. Their selling prices, the usage of X, Y and Z in their production, and the other variable costs incurred in Division 2 are :

*Products per tonne**

	<i>L</i>	<i>M</i>	<i>N</i>	<i>P</i>
Selling price	Rs. 31,000	Rs. 37,000	Rs. 24,000	Rs. 35,000
Usage of product :				
X (kgs.)	220	400	—	—
Y (kgs.)	400	—	250	150
Z (kgs.)	—	300	200	450
Other variable costs	Rs. 4,680	Rs. 5,570	Rs. 3,305	Rs. 5,635

Division 2 can buy product X from outside the group at Rs. 26 per kg. but it is of inferior quality and the Division has to reduce its selling price by 5% if it uses the outside material.

It can also buy up to 10 tonnes per annum of product Z at a cost of Rs. 38 per kg. delivered.

Division 2 capacity is 100 tonnes of output. Its policy is to sell a minimum of 10 tonnes per annum per product. Its fixed overhead is Rs. 6,00,000 per annum.

The group's rules for fixing transfer prices between Divisions are :

1. Where a product is sold outside the group, the average external price (less any special packaging costs) is to be used.

2. If the product is not sold outside the group, the transfer price per kg. comprises the sum of

—the variable cost,

—the fixed cost that would apply if equal quantities (in kgs.) of each product were sold,

—5% margin on the total of variable cost plus fixed cost.

You are required to state, with supporting evidence :

(a) whether the transfer pricing rules make for goal congruence between the Divisions ;

(b) what arrangement of production, purchasing and selling of products achieves the most profitable outcome for :

(i) the group as a whole

(ii) Division 2.

(C.I.M.A. London, May 1987)

Solution.

Necessary Workings :

Allocation of fixed overhead in Division 1:

Hours available = 1,50,000

Total time taken to make one kilogramme of each product is

X 2.5 hours	} total 7.5 hours
Y 3.0 hours	
Z 2.0 hours	

Therefore, if equal quantities of each product are made, the quantity

$$\frac{150,000}{7.5} = 20,000 \text{ kg}$$

$$\text{Fixed overhead per process hour} = \frac{\text{Rs. } 3,00,000}{1,50,000} = \text{Rs. } 2$$

$$\text{Allocation : } X \ 2.5 \times \text{Rs. } 2 = \text{Rs. } 5 \times 20,000 = 1,00,000$$

$$Y \ 3.0 \times \text{Rs. } 2 = \text{Rs. } 6 \times 20,000 = 1,20,000$$

$$Z \ 2.0 \times \text{Rs. } 2 = \text{Rs. } 4 \times 20,000 = 80,000$$

3,00,000

Transfer prices per group (rule 2) in Rs. per kg:

Product	Variable cost	Fixed cost	Plus 5% of variable and fixed costs	Total
X	12.0	5.0	0.850	17.850
Y	25.0	6.0	1.550	32.550
Z	34.5	4.0	1.925	40.425

(a) Transfer pricing and goal congruence between the Divisions

Only two products have alternative suppliers

—Product X

Supplied by Division 1 to an outside customer at Rs. 32 per kg. including special packaging costs of Re. 1 per kg. Therefore, the net price of Rs. 31 becomes the transfer price to Division 2. Division 2, however, can buy outside at Rs. 26 per kg. plus a product selling price differential of 5% of Rs. 31 = Rs. 1.55 when used in product *L* or 5% of Rs. 37 = Rs. 1.85 when used in product *M*. Assuming the most extreme case of 100% usage in product *M*, the price is then Rs. 27.85 kg. This is well below the Division 1 transfer price of Rs. 31 per kg. If Division 1 had no outside sales, then the transfer price to Divisions 2 would be Rs. 17.85 per kg. (see workings). This would be Rs. 10 per kg. cheaper than Division 2 can buy outside. Thus Division 2 is penalised by Division 1 outside sales.

—Product Z

Supplied by Division 1 at Rs. 40.425 (see workings). This is in excess of the price of Rs. 38 per kg at which Division 2 can buy from outside sales.

Conclusion. The transfer price rules do not make for goal congruence between the Divisions.

(b) The arrangement of production, purchasing and selling of products which will achieve the most profitable outcome.

(i) *For the group as a whole*

In Division 1 :

The variable cost of product *X* of Rs. 12 per kg is below the price Division 2 can buy outside of Rs. 26+. Thus from a group viewpoint, internal purchases should be made. There is no alternative supply of product *Y*. The variable cost of product *Z* of Rs. 34.50 per kg is below the Rs. 38 per kg available outside. So again internal purchases should be made.

On this basis, the production position (per tonne) is :

	<i>L</i>		<i>M</i>		<i>N</i>		<i>P</i>	
	kg.	Rs.	kg.	Rs.	kg.	Rs.	kg.	Rs.
Variable cost								
Division 1 :								
<i>X</i> at Rs. 12 per kg	220	2,640	400	4,800	—	—	—	—
<i>Y</i> at Rs. 25 per kg	400	10,000	—	—	250	6,250	150	3,750
<i>Z</i> at Rs. 34.50 per kg	—	—	300	10,350	200	6,900	450	15,525
Division 2		4,680		5,570		3,305		5,635
Total variable cost		17,320		20,720		16,455		24,910
Selling price		31,000		37,000		24,000		35,000
Contribution		13,680		16,280		7,545		10,090

Only product *X* can be sold outside the company on the above basis up to 20,000 kg at Rs. 31 per kg (net). From the above table, product *X* used in product *L* yields Rs. 62.20 per kg contribution and in product *M*, Rs. 40.70 per kg contribution. Therefore, there is no financial incentive to sell outside if supplies are limited.

In Division 2 :

There is a marketing requirement to sell at least 15,000 kg of each product. This would require the following quantities of input material :

	<i>L</i> kg	<i>M</i> kg	<i>N</i> kg	<i>P</i> kg	Total kg
<i>X</i>	3,300	6,000	—	—	9,300
<i>Y</i>	6,000	—	3,750	2,250	12,000
<i>Z</i>	—	4,500	3,000	6,750	14,250

Process hours needed in Division 1 :

	kg	Hours per kg	Total hours
<i>X</i>	9,300	2.5	23,250
<i>Y</i>	12,000	3.0	36,000
<i>Z</i>	14,250	2.0	28,500
Total hours use			87,750
Available hours			1,50,000
Balance			62,250

The balance should be used for product *M* as this yields the greatest contribution. Process time required per kg = $(0.4 \times 2.5) + (0.3 \times 2.0) = 1.6$ hours. Therefore, additional product *M* which could be produced

$$= \frac{62,250}{1.6} = 38,906 \text{ kg.}$$

Optimum production :

	<i>L</i> kg	<i>M</i> kg	<i>N</i> kg	<i>P</i> kg
Production	15,000	53,906	15,000	15,000
Input required				
<i>X</i>	3,300	21,562	—	—
<i>Y</i>	6,000	—	3,750	2,250
<i>Z</i>	—	16,172	3,000	6,750
Process time	Total requirement kg	Process time per kg hours	Total process time hours	
<i>X</i>	24,862	2.5	62,155	
<i>Y</i>	12,000	3.0	36,000	
<i>Z</i>	25,922	2.0	51,844	
			<hr/> 1,49,999 <hr/>	

This also meets Division 1 sales requirement of minimum of 12,000 kg of each product.

Most profitable arrangement for the group as a whole :

	<i>Division 1</i>	<i>Division 2</i>
Production	tonnes	tonnes
<i>X</i>	24,862	15,000
<i>Y</i>	12,000	53,906
<i>Z</i>	25,922	15,000
Purchases	kg	kg
No products purchased }		<i>X</i> 24,862 at Rs. 31.00
		<i>Y</i> 12,000 at Rs. 32.55
		<i>Z</i> 25,922 at Rs. 38.00
Sales	kg	tonnes
<i>X</i>	24,862 at Rs. 31.00	15,000 at Rs. 31,000
<i>Y</i>	12,000 at Rs. 32.55	53,906 at Rs. 37,000
<i>Z</i>	25,922 at Rs. 38.00	15,000 at Rs. 24,000
		<i>P</i> 15,000 at Rs. 35,000

(ii) For Division 2

If product *X* is bought from outside at Rs. 26 per kg and the end-product selling price is reduced by 5%, the effect on contribution is :

	<i>L</i> Rs. per tonne	<i>M</i> Rs. per tonne
Saving	220 × Rs. 5 1,100	400 × Rs. 5 2,000
Loss on selling price	5% × Rs. 31,000 (1,550)	5% × Rs. 37,000 (1,850)
Increase (decrease)	<hr/> (450) <hr/>	<hr/> 150 <hr/>

Therefore, product *X* should be bought from outside for product *M*.

If product *Z* is bought from outside at Rs. 38 per kg, it is cheaper than the transfer price from Division 1 of Rs. 40·425 per kg (see workings) and should be used to the extent of the 10 tonnes per annum available. By buying from outside, Division 2 could then increase sales of product *M* to 55 tonnes. This would increase the input requirement of product *Z*, by $1·094 \times 300 \text{ kg} = 328 \text{ kg}$ and increase the product *Z* purchase shown in section (i) from 25,922 kg to 26,250 kg.

Product *X* requirement would also increase by $1·094 \times 400 \text{ kg} = 438 \text{ kg}$ and would need a total purchase increase from 24,862 kg to 25,300 kg.

Most profitable arrangement for Division 2 :

Production	tonnes	Sales	tonnes	Rs. per tonne
	<i>L</i> 15		<i>L</i> 15	31,000
	<i>M</i> 55		<i>M</i> 55	35,150
	<i>N</i> 15		<i>N</i> 15	24,000
	<i>P</i> 15		<i>P</i> 15	35,000
Purchases	kg			
	Ex Division 1			
	<i>X</i> 3,300 at Rs. 31 per kg			
	<i>Y</i> 12,000 at Rs. 32·55 per kg			
	<i>Z</i> 16,250 at Rs. 40·425 per kg			
	From outside			
	<i>X</i> 22,000 at Rs. 26 per kg			
	<i>Z</i> 10,000 at Rs. 38 per kg			

Contribution approach to transfer pricing

Problem 13·20. Division A of Better Margins Ltd. has been given a budgeted target of selling 2,00,000 components COM 21, it manufactures at a price which would fetch a return of 25% on the average assets employed by it. The following figures are relevant :

Fixed Overhead	Rs. 4,00,000
Variable Cost	Re. 1 per unit
Average assets :	
Sales Debtors	2,00,000
Stocks	6,00,000
Plant and other assets	4,00,000

However, the marketing department of the company finds out by a survey that the maximum number of COM 21, the market can take, at the proposed price is only 1,40,000 units.

Fortunately Division B is willing to purchase the balance 60,000 units. The Manager, Division A is willing to sell to Division B at a concessional price of Rs. 4 per unit. But the Manager, Division B is ready to pay Rs. 2.25 only per unit, as he feels he can himself make COM 21 in his Division at that price.

Rather than sell to Division B at Rs. 2.25, the Manager, Division A feels he will restrict the activity of his Division to the manufacture and sale of 1,40,000 components only. By this, he could reduce Rs. 80,000 in stocks, Rs. 1,20,000 of plant and other assets and Rs. 40,000 in Selling and Administration Expenses.

As a Cost Accountant, you are asked to work out the various computations and show that selling 60,000 COM 21 to Division B at Rs. 2.25 per unit would be in the interest of the organisation.

(I.C.W.A. Final, Dec. 1983)

Solution. Neither selling price nor total sales is given. Division A of Better Margins Ltd expects a return of 25% on average assets employed i.e., Rs. 12,00,000.

Total sales will be :

(a) Profit (25% of 12,00,000)	Rs. 3,00,000
(b) Fixed overhead	4,00,000
(c) Variable cost (2,00,000 × Re 1)	2,00,000
Total sales	9,00,000

Sales per unit (9,00,000 ÷ 2,00,000)	Rs. 4.50
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	Transfer to Division B and sale to outside parties	Sale to outside parties only
Sales (units)	2,00,000	1,40,000
Sales value (1,40,000 @ 4.50)	Rs. 6,30,000	Rs. 6,30,000
(60,000 @ 2.25)	1,35,000	Nil
	7,65,000	6,30,000
Less : Variable cost (Re. 1 per unit)	2,00,000	1,40,000
Contribution	5,65,000	4,90,000
Less : Fixed overhead	4,00,000	3,60,000*
Net profit	1,65,000	1,30,000
Average assets employed	12,00,000	10,00,000
Return on investment	13.75%	13.00%

If the component is transferred to Division B as well as sold to outside parties, it is more profitable as the contribution, net profit and return in investment is more than the existing proposal. Therefore selling the component to Division B at Rs. 2·25 p.a. is in the overall interest of the company.

*Reduction in selling and administration expenses (fixed in nature) by Rs. 40,000.

Evaluation of proposals—Inter—division quotations vs. outside quotation

Problem 13·21. The Engineering Division of Profit Goal Ltd. has redesigned a product so that it will need a new plastic part. The fabrication Division of the company can easily make this part and it has been asked to give a quotation. In the meanwhile an outside supplier who has been anxious to get an entry into the company's business has agreed to supply at Rs. 115 per hundred parts while the quotation worked out in the normal way received from the Fabrication Department amounts to Rs. 121·40 per hundred parts. When the less expensive outside quotation is brought to the notice of the Manager fabrication Division he is not willing to reduce the figure from Rs. 121·40 as his Division is already making good profit working at 80% capacity and this order from Engineering Division would be no more than 2% of its capacity. The Managers of both the Divisions have been maintaining very cordial relations with each other as the production facilities of their Division are adjacent to each other, the Manager Fabrication Division himself has asked the Manager Engineering Division to procure the plastic part from outside.

The Managing Director, who has come to know of this, feels unhappy that when facilities exist within the company to make the necessary part, a division should go outside to procure it on account of unfavourable price. He asks you as a Cost Accountant of the company to study the transfer pricing method and arrive at a price which would be acceptable to both the Divisions and in the best interest of the whole company. Find out whether the Manager Fabrication Division can match the outside quotation and still make profit for his division and the company as a whole. When you have gathered following data :

<i>Quotation from Fabrication</i>	
Estimated cost	
per 1,000 parts	
Raw Material	Rs. 30·00
Direct Labour	20·00
Variable Overhead	
(100% Direct Labour)	20·00
Fixed Overhead	
(75% of Direct Labour)	15·00
Standard freight allowance	2·40
Sales Commission	8·50
Profit Margin (30% of raw material, direct labour and overhead)	25·50
	<hr/>
	121·40
	===

Each division is evaluated on a profit centre basis and corporate management charges each division 15% of sales as its share of the corporate administrative expense. (I.C.W.A. Final, June 1984)

Solution. Following costs are irrelevant to the division to buy the part from outside :

- (i) Fixed overhead of Rs. 15 per unit
- (ii) Standard freight allowance
- (iii) Sales commission.

Therefore, cost of 100 plastic parts to the Fabrication Division will be :

Raw Material	30.00
Direct Labour	20.00
Variable Overhead	20.00
	70.00

From overall company's point of view, if the part is made in the company only Rs. 70.00 will be spent ; if it is procured from outside Rs. 115 will be spent. Therefore it is profitable to make the part inside the company rather than buy it from outside, from the corporate point of view.

From the Fabrication Division point of view, if it quotes matching the outside price, it can provide for corporate administrative expenses at 15% of Rs. 115, i.e., Rs. 17.25 and still earn much more than the profit that it wanted on this order

Cost of 100 plastic parts	Rs 70.00
Provision for corporate administration	17.25
Profit wanted on the order	27.50
	112.75

Therefore, it can comfortably quote at Rs. 115.

From the Engineering Division point of view, as long as it does not have a more favourable quotation, it will buy from inside.

Transfer Pricing (consideration of opportunity cost)

Problem 13.22. Division A is a profit centre which produces three products X, Y and Z. Each product has an external market.

	X	Y	Z
External market price per unit	Rs. 48	Rs. 46	Rs. 40
Variable cost of production in division A	Rs. 33	Rs. 24	Rs. 28
Labour Hours required per unit in division A	3	4	2

Product Y can be transferred to Division B, but the maximum quantity that might be required for transfer is 300 units of Y.

The maximum external sales are :

X 800 units
Y 500 units
Z 300 units

Instead of receiving transfers of product Y from Division A, Division B could buy similar product in the open market at a slightly cheaper price of Rs. 45 per unit.

What should the transfer price be for each unit for 300 units of Y, if the total labour hours available in Division A are :

(a) 3800 hours

(b) 5600 hours

(I.C.W.A. Final, June 1988)

Solution. Working Notes :

(i) Hours required to meet maximum demand :

External Sales		Hours reqd. per unit	Total Hrs.
X 800 units	×	3	= 2,400
Y 500 units	×	4	= 2,000
Z 300 units	×	2	= 600
			<hr/> 5,000 <hr/>

(ii) Contribution per unit :

	X	Y	Z
Selling Price	Rs. 48	Rs. 46	Rs. 40
Variable Cost	33	24	28
	<hr/> 15	<hr/> 22	<hr/> 12
Contribution per unit	15	22	12
Labour hours required per unit	3	4	2
Contribution per hour	5	5.5	6
Ranking	III	II	I

(a) If only 3,800 hours are available in Division A.

300 units of Z (Maximum), which will take* = 600 hrs.

500 units of Y (maximum), which will take = 2,000 hrs.

400 units of X to use remaining hrs. = 1,200 hrs.

3,800 hrs.

***Note :** Labour hours required per unit are given in the question. If 300 units of Y are to be transferred to 'B' division, then 1,200 hours will have to be used for production of Y instead of X. It means Division A will sacrifice production of 400 units of X, which are yielding Rs. 5 per hr. Given above is the optimum mix for Division A for 3,800 hrs. If 300 units of Y are to be transferred to 'B' division with time constraint of 3,800 hours, then additional 300 units of Y will have to be produced sacrificing the production of 400 units of X, which is yielding contribution.

Transfer price

(i) Variable cost of Y = Rs 24.00

Opportunity Cost

(ii) Contribution relating to 'X' forgone
for producing additional units of Y
4 hrs \times Rs. 5* = 20.00

44.00

*Y takes 4 hours and in each hour production of X would have generated contribution of Rs 5.

(b) If 5,600 hours are available

Maximum time required to meet

external sales (Refer to working Note 1) = 5,000 hrs.

Hours now available = 5,600 hrs

(i) It means 600 hrs can be easily used for production Y and transfer price will be variable cost only

i.e. (600 hrs \div 4 hrs) \times Rs. 24 = 3,600

Note : Y takes 4 hrs per unit

(ii) For producing additional 150 units,
production of X will be disturbed.

(i) i.e. 150 units of X @ Rs. 24 = 3,600

Opportunity Cost

(ii) Contribution of 'X' units
forgone 600 hrs \times Rs 5 = 3,000* 6,600

Total price for 300 units 10,200

\therefore Average transfer price should be Rs. 34 per unit

*Contribution per hr. of X forgone.

Inter-Division Transfer Pricing (Goal Congruence)

***Problem 13.23** A company has two Divisions. The output of Division X is product Xen. There is a market outside the company for product Xen, but this product is mainly used by Division Y which has first call on Division X's output. Division Y's output is product Yang, all of which is sold outside the company.

The maximum capacity per annum of the Divisions is

X	1,30,000 units of Xen
Y	50,000 units of Yang

Each Division maintains a stable level of stocks throughout the year.

The company has examined the results of four different scenarios shown below using for each the following bases of transfer pricing for product Xen.

- Market price (*M*)
- Absorbed standard cost (*A*)
- Variable cost plus a lump of 80% of Division X's fixed cost (*V*)

The scenarios are :

Scenario number	Product Xen		Product Yang	
	Market price (Rs. per unit)	Total demand ('000 units)	Market price (Rs. per unit)	Total demand ('000 units)
1	60	100	200	40
2	50	70	180	30
3	70	130	180	30
4	70	130	230	30

Standard costs per unit :

Variable cost*	Rs. 40	Rs. 24 (excluding 2 units of Xen)
*Direct materials cost included above	Rs. 12	Rs. 8
Fixed cost based on budgeted volume (units per annum)	Rs. 10 1,00,000	Rs. 36 40,000

The resulting profits are shown in the following table :

Transfer price	Scenario	Profit (Loss)	
		Division X Rs. '000	Division Y Rs. '000
(M) Market price	1	1,000	800
	2	(300)	240
	3	2,900	1,860
	4	2,900	(960)
(A) Absorbed standard cost	1	200	1,600
	2	(300)	240
	3	900	3,860
	4	1,700	240
(V) Variable cost + 80% fixed cost	1	200	1,600
	2	(100)	40
	3	700	4,060
	4	1,900	40

You are required :

(a) assuming that a major objective of setting a transfer price is to achieve goal congruency, to recommend which basis of transfer price

should be used for product Xen, and justify your recommendation using the data in the profits table ;

(b) assuming that Division Y receives an overseas order for 20,000 units of Yang that will in no way influence its other clientele, to recommend, with supporting calculations, acceptance or refusal of the order under each of the following two scenarios :

Scenario 2 Price per unit (ex factory) Rs. 110 Transfer price basis (A)

Scenario 3 Price per unit (ex factory) Rs. 130 Transfer price basis (M)

(i) as manager of Division Y.

(ii) as Managing Director of the company.

(c) assuming that no market price for product Xen existed, to

(i) calculate a transfer price for product Xen, explaining the reasoning behind the calculation,

(ii) calculate what profit would result from using that transfer price under scenario 1 (using the figures in respect of product Yang only).
(C.I.M.A. London, May 1988)

Solution. (a) **Transfer price for product Xen to Division Y**

Recommendation : Product Xen should be transferred to Division Y at market price. Justification for the recommendation :

- (i) The market price is the most objective criterion for measurement in this type of situation. It reflects what Division Y would have to pay if it bought the product from a supplier outside the company. Therefore, any profit resulting from its activities can be treated as on par with what would have happened if it had been operating independently of the company.
- (ii) As can be seen from the profit table, the use of market price shows profits for Division X that are strongly in line with the price and quantity of Xen that is sold during the period. Although, to a certain extent, a similar pattern (that is a drop into loss from scenario 1 to scenario 2 and then a rise to scenario 3 and 4) is shown by the use of bases A and V, the market price basis is the only one to show the same profit for Division X for scenarios 3 and 4 where both the price and the quantity demanded are the same. The other two bases, however, yield different profits, affected as they are by the quantities taken up by Division Y at a lower price than is obtained from outside.
- (iii) Division Y's profit is almost always greater under bases A and V than under the market price basis and, in the case of scenarios 3 and 4, very much greater. This, of course, is at the expense of Division X. One can see some justification for this under scenario 4 where both quantity and price are well above scenario 1, which effectively represents the budgeted situation. There is little, if any, justification under scenario 3, where both

are below this budget level whilst those of Division X are above budget.

- (iv) The above two paragraphs support the choice of the market price basis from the viewpoint of goal congruence between the two divisions. For scenario 1 the profits are fairly evenly divided on a market price basis with the balance in favour of Division X with its rather heavier costs. From there onwards, profits are closely related to quantity demanded and price. This is fairly easily understandable and defensible, whereas anomalies resulting from the other two bases could cause friction, particularly with the manager of Division X.

(b) **Overseas order for 20,000 units**

(i) **As manager of Division Y**

Scenario 2A

		<i>Rs. per unit</i>
Selling price		110
Costs ex × 2 at Rs. 50 = Rs. 100		
Own variable costs	24	124
		<hr/>
Loss		(14)
		<hr/>

Recommendation : Refusal of the overseas order

Scenario 3M

		<i>Rs. per unit</i>
Selling price		130
Costs ex × 2 at Rs. 70 = Rs. 140		
Own variable costs	24	164
		<hr/>
Loss		(34)
		<hr/>

Recommendation : Refusal of the overseas order

(ii) **As Managing Director of the Company**

Scenario 2A

		<i>Rs. per unit</i>
Selling price		110
Costs ex × 2 at Rs. 40 = Rs. 80		
ex Y	24	104
		<hr/>
Profit		6
		<hr/>

Recommendation : Acceptance of the overseas order

Scenario 3M

Selling price		<i>Rs. per unit</i>
Costs ex X		130
(at full capacity, therefore outside sale forgone)		
2 at Rs. 70 =	Rs. 140	
Y	24	164
	<hr/>	<hr/>
Loss		(34)
		<hr/>

Recommendation : Refusal of the overseas order

(c) (i) Calculating a transfer price

In the absence of a market price, the next most suitable basis would be one related to return on investment. However, as this information is not available, the best transfer price would be one that shared profit relative to the costs involved. It can be assumed that the costs indicate the respective amounts of effort put into the joint production effort. The question indicates that the direct material used by each department is a similar proportion in each division, that is 30% of variable costs for X and 33% for Y.

Profit statement for 40,000 Yang under scenario 1

		Rs. '000	Rs. '000
Selling price	40,000 at Rs. 200 each		8,000
X costs Variable	80,000 × Rs. 40	3,200	
Fixed	1,00,000 × Rs. 10	1,000	
Y costs Variable	40,000 × Rs. 24	960	
Fixed	40,000 × Rs. 36	1,440	6,600
		<hr/>	<hr/>
Profit			1,400
			<hr/>

Rs. '000

X share of profit would be $4,200 \times 1,400 \div 6,600 = \text{Rs. } 891$

Total cost of 80,000 Xen = Rs. 4,200 + Rs. 891 = Rs. 5,091

Cost per Xen = Rs. 64

Ans.

(ii) Divisional profit statements

			Rs. '000
Division X			
Sales to Division Y	80,000 at Rs. 64 each		5,120
Costs : Variable	80,000 at Rs. 40	3,200	
Fixed	1,00,000 at Rs. 10	1,000	4,200
		<hr/>	<hr/>
Profit			920
			<hr/>

Division Y

Sales	40,000 at Rs. 200 each		8,000
Costs : Ex Division X	80,000 at Rs. 64	5,120	
Variable	40,000 at Rs. 24	960	
Fixed	40,000 at Rs. 36	1,440	7,520
Profit			480

Note : Other transfer price bases may be equally as acceptable in part (c) (i) and may lead to different answers in part (c) (ii).

Transfer Pricing (Profit centre)

Problem 13.24. A Company with two manufacturing divisions is organised on profit centre basis. Division 'A' is the only source for the supply of a component that is used in Division B in the manufacture of a product KLIM. One such part is used in each unit of the product KLIM. As the demand for the product is not steady, Division B can obtain orders for increased quantities only by spending more on sales promotion and by reducing the selling prices. The Manager of Division B has accordingly prepared the following forecast of sales quantities and selling prices

Sales in units per day	Average Selling Price per unit of KLIM
1,000	Rs. 5.25
2,000	3.98
3,000	3.30
4,000	2.78
5,000	2.40
6,000	2.01

The manufacturing cost of KLIM in Division B is Rs. 3,750 for first 1,000 units and Rs. 750 per 1,000 units in excess of 1,000 units.

Division A incurs a total cost of Rs. 1,500 per day for an output up to 1,000 components and the total costs will increase by Rs. 900 per day for every additional 1,000 components manufactured. The Manager of Division A states that the operating results of his Division will be optimised if the transfer price of the component is set at Rs. 1.20 per unit and he has accordingly set the aforesaid transfer price for his supplies of the component to Division A. Required :

(a) Prepare a schedule showing the profitability at each level of output for Division A and Division B.

(b) Find the profitability of the company as a whole at the output level at which

(i) Division A's net profit is maximum.

(ii) Division B's net profit is maximum.

(c) If the Company is not organised on profit centre basis, what level of output will be chosen to yield the maximum profit.

(I.C.W.A. Final Dec., 1988)

Solution. Division A (a) (i) Statement showing the profitability at various levels of output

<i>Sales per day (unit)</i>	<i>Transfer Price @ Rs. 1.2 per unit</i>	<i>Cost per day</i>	<i>Profit per day</i>
1,000	Rs. 1,200	Rs. 1,500	(Rs. 300)
2,000	2,400	2,400	—
3,000	3,600	3,300	300
4,000	4,800	4,200	600
5,000	6,000	5,100	900
6,000	7,200	6,000	1,200

Division B (a) (ii)

<i>Sales per day (units)</i>	<i>Sales Value per day</i>	<i>Cost of component (Division A)</i>	<i>Other mfg. Cost (Division B)</i>	<i>Total Cost</i>	<i>Profit</i>
1,000	Rs. 5,250	Rs. 1,200	Rs. 3,750	Rs. 4,950	Rs. 300
2,000	7,960	2,400	4,500	6,900	1,060
3,000	9,900	3,600	5,250	8,850	1,050
4,000	11,120	4,800	6,000	10,800	320
5,000	12,000	6,000	6,750	12,750	(750)
6,000	12,060	7,200	7,500	14,700	(2,640)

(b) Profitability of the company as a whole at the output level of which Division A and Division B profit is maximum

<i>Output level</i>	<i>A's Profit</i>	<i>B's Profit</i>	<i>1,060</i>
6,000	Rs. 1,200	<i>Add A's Profit</i>	—
<i>Less B's Division loss</i>	<i>(2,640)</i>	<i>Profit</i>	<i>1,060</i>
<i>Loss</i>	<i>(1,440)</i>		

(c) If the company is not organised on profit centre basis

<i>Sales per day (units)</i>	<i>Sales Value</i>	<i>Division A's Cost</i>	<i>Division B's Cost</i>	<i>Total Cost</i>	<i>Profit</i>
1,000	Rs. 5,250	Rs. 1,500	Rs. 3,750	Rs. 5,250	Rs. NIL
2,000	7,960	2,400	4,500	6,900	1,060
3,000	9,900	3,300	5,250	8,550	1,350
4,000	11,120	4,200	6,000	10,200	920
5,000	12,000	5,100	6,750	11,850	150
6,000	12,060	6,000	7,500	13,500	(1,440)

Profit is maximum at 3,000 output level.

Problem 13-25 (Recommending Transfer price as a Group Management Accountant.) A group has two companies:

K Ltd. which is operating at just above 50% capacity, and

L Ltd. which is operating at full capacity (7,000 production hours).

L Ltd produces two products, X and Y, using the same labour force for each product. For the next year its budgeted capacity involves a commitment to the sale of 3,000 kgs of Y, the remainder of its capacity being used on X.

Direct costs of these two products are:

	X	Y
	Rs. per kg	Rs. per kg
Direct materials	18	14
Direct wages	15 (1 production hour)	10 ($\frac{2}{3}$ production hour)

The company's overhead is Rs. 1,26,000 per annum relating to X and Y in proportion to their direct wages. At full capacity, Rs. 70,000 of this overhead is variable. L Ltd. prices its products with a 60% mark-up on its total costs.

For the coming year, K Ltd wishes to buy from L Ltd 2,000 kgs of product X which it proposes to adopt and sell as product Z for Rs. 100 per kg. The direct costs of adaptation are Rs. 15 per kg. K Ltd's total fixed costs will not change, but variable overhead of Rs. 2 per kg will be incurred.

You are required to recommend, as group management accountant:

(a) at what range of transfer prices, if at all, 2,000 kgs of product X should be sold to K Ltd;

(b) what other points should be borne in mind when making any recommendations about transfer prices in the above circumstances?

(CIMA London May 1989)

Solution: Workings:

L Ltd. Profit statement for product X

	Rs. per kg.
<i>Variable Costs</i>	
Direct Materials	18
Direct Wages	15 (one production hour)
Variable Overhead	<u>10</u> (Rs. 700,00 ÷ 7000 hrs.)
	43
<i>Fixed Overhead</i>	
(Rs. 1,26,000 – Rs. 70,000) ÷ 7000	<u>8</u>
Total Cost	51
Profit	<u>30·60</u> (60% of total Cost)
Selling Price	<u>81·60</u>

If L Ltd sells to K Ltd. at the existing price of Rs 81·60 per kg. then K Ltd will make a profit of Rs. 1·40 per kg. i.e. Rs. 100 – (Rs. 81·60 + Rs 15 + Rs 2). On the total order of 2,000 kg the profit would be Rs. 2,800.

(a) (i) Should the 2,000 kg. of product X be sold to K. Ltd.?

The answer is yes, if there is no long-term detrimental effects on L Ltd's total business.

(ii) What range of transfer prices might be acceptable?

From L Ltd.'s viewpoint. At Rs. 81-60 per kg the L. Company is charging from K Ltd. What it charges when it sells outside the group. Market price is normally considered as the best transfer price as it gives buyer and seller an equitable basis for inter-company trading.

From K. Ltd.'s point of view. At Rs. 81-60 per kg, K Ltd is making only a small margin of Rs. 1-40 per kg. on the incremental cost of Rs. 17, which is equal to about 8%. This is well below L Ltd's margin included in transfer price. K Ltd could point out that L Ltd will save some variable overhead for example transport, advertisement and credit control etc. This is unlikely to be more than Rs. 2 of the Rs. 10 per kg variable overhead, which is categorised as Company's Overhead which include production, selling and distribution and administration expenses. This should reduce the transfer price by Rs. 2 + 60% of Rs. 2 = Rs. 3-20 to Rs. 78-40 per kg. L Ltd may counter argue that switching products to K Ltd may have long term disadvantages to their established business. K Ltd cannot give up its meagre profit of Rs. 1-40 per kg.

Recommendation—Transfer price may range from Rs. 78-40 to Rs. 81-60 per kg.

(b) Other points to be borne in mind in recommending transfer price.

(i) Even a small additional profit of Rs. 2,800 may improve staff morale.

(ii) New product Z may have an expanding market and there may be a possibility of higher prices in future.

(iii) Impact of this transaction on business of L Ltd.

(iv) Can L. Ltd improve its output X by working overtime or by sub-contracting so as to handle present business *plus* extra 2000 kg.?

Problem 13-26 (Transfer Pricing based on market price method and cost Method.) SV Ltd manufactures a product which is obtained basically from a series of maxing operations. The finished product is packaged in the company—made glass bottles and packed in attractive cartons.

The company is organised into two independent divisions viz. one for the manufacture of the end—product and the other for the manufacture of glass bottles. The product manufacturing division can buy all the bottle requirements from the bottle manufacturing division.

The General Manger of the bottle manufacturing division has obtained the following quotations from the outside manufacturers for the supply of empty bottles.

<u>Volume empty bottles</u>	<u>Total purchase value (Rs.)</u>
8,00,000	14,00,000
12,00,000	20,00,000

A cost analysis of the bottle manufacturing division for the manufacture of empty bottles reveals the following production costs:

Volume empty bottles	Total cost Rs.
8,00,000	10,40,000
12,00,000	14,40,000

The production cost and sales value of the end product marketed by the product manufacturing division are as under:

Volume (Bottles of end product)	Total Cost of end product (excluding cost of empty bottles)	Sales Value (Packed in bottles)
8,00,000	Rs. 64,80,000	Rs. 91,20,000
12,00,000	Rs. 96,80,000	Rs. 1,27,80,000

There has been considerable discussion at the corporate level as to the use of proper price for transfer of empty bottles from the bottle manufacturing division to product manufacturing division. This interest is heightened because a significant portion of the Divisional General Manager's salary is in incentive bonus based on profit centre results.

As the corporate management accountant responsible for defining the proper transfer prices for the supply of empty bottles by the bottle manufacturing division to the product manufacturing division, you are required to *show for the two levels of volumes of 8,00,000 and 12,00,000 bottles, the profitability by using (i) market price and (ii) shared profit relative to the costs involved basis for the determination of transfer prices.* The profitability position should be furnished separately for the two divisions and the company as a whole under each method. Discuss also the effect of these methods on the profitability of the two divisions. (ICWA Final June 1989)

Solution :

Statement showing profitability of two divisions at two different levels of output using different transfer prices

No. of bottles	<u>8,00,000</u>	<u>12,00,000</u>
Sales Value (Packed Product)	Rs. 91,20,000	1,27,80,000
Less Costs		
Product Manufacturing Division	64,80,000	96,80,000
Bottle Manufacturing Division	<u>10,40,000</u>	<u>14,40,000</u>
Total costs	<u>75,20,000</u>	<u>1,11,20,000</u>
Profit	<u>16,00,000</u>	<u>16,60,000</u>
Profit pro-rated to Bottle Mfg. Division and Product Mfg. Division.		
Share of Bottle Manufacturing Division:		
$16,00,000 \times 10,40,000 / 75,20,000$	2,21,276	
$16,60,000 \times 14,40,000 / 1,11,20,000$		2,14,964
Balance profit relates to Product Mfg. Division	<u>13,78,724</u>	<u>14,45,036</u>
	<u>16,00,000</u>	<u>16,60,000</u>

Transfer Prices of bottles

Cost	10,40,000	14,40,000
Profit as computed above	<u>2,21,276</u>	<u>2,14,964</u>
Total price	<u>12,61,276</u>	<u>16,54,964</u>
Transfer price per bottle	Rs. <u>1-577</u>	Rs. <u>1-379</u>

From the above computations, it is observed that shared profit relative to the cost involved is Rs. 2,21,276 (Rs. 0-2766 per bottle) at 8,00,000 production level and Rs. 2,14,964 (Rs. 0-179 per bottle) at 12,00,000 production level. The profit of Product Mfg. Division is Rs. 13,78,724 (Rs. 1-723 per bottle) at 8,00,000 production level and Rs. 14,45,036 (Rs. 1-2042 per bottle) at 12,00,000 production level.

Profitability based on Market Price

No of bottles	8,00,000	12,00,000
<i>Bottle Mfg. Division</i>		
Market price	Rs. 14,00,000	Rs. 20,00,000
Less: Cost	<u>10,40,000</u>	<u>14,40,000</u>
Profit (i)	<u>3,60,000</u>	<u>5,60,000</u>
<i>Product Mfg. Division</i>		
Sales	91,20,000	1,27,80,000
Less: Bottle Cost	14,00,000	20,00,000
Product Cost	<u>64,80,000</u>	<u>96,80,000</u>
Profit (ii)	<u>12,40,000</u>	<u>11,00,000</u>
Total	<u>16,00,000</u>	<u>16,60,000</u>

<i>Production Level</i>	Profit based on cost (Rs./ Lakhs)		Profit based on market price (Rs./ Lakhs)	
	<i>Bottle Mfg. Division</i>	<i>Product Mfg. Division</i>	<i>Bottle Mfg. Div.</i>	<i>Product Mfg. Div.</i>
8,00,000 bottles	2-21	13-79	3-60	12-40
12,00,000 bottles	2-15	14-45	5-60	11-00

Observations :

1. Market price methods gives a better profitability to Bottle Mfg. Division at both the production level.
2. Market price method gives a lower profitability to Product Mfg. Division as compared to Bottle Mfg. Division.
3. Under Cost-based method, there is a better profit at lower level of production in Bottle Mfg. Division. However in Product Mfg. Division 12,00,000 production level gives a higher profit. But in Market price method, the position is quite reverse.

Authors' Special Notes

This Chapter is most important for I.C.W.A. (Final) students. Rate of Return Pricing and Transfer Pricing are its two facets. Key thrust areas are :

1. Sometimes, special instructions given for computation of "capital employed" and return on fixed assets should be followed (Problem 13-3). Relation between pretax profit and post-tax profit should be properly understood.

2. Special care should be taken to compute Capital Employed and "Net Worth" and return thereon (Problem 13-5, A 14).

3. Focus your attention how royalty on sales is worked out when selling price is unknown (Problem 13-6). In case of two unknown variable, a suitable equation has to be determined.

4. Note how profit is found out before and after carrying out revaluations and other adjustments (Problem 13-9)

5. Cost-plus pricing : Note the different methods of overhead recovery (Problem A 52)

6. *Transfer Pricing* Transfer price at different capacity levels (Problem 13-11); Contribution Approach (Problems 13-13, 13-15, 13-20); Effect of alternative transfer pricing on profit (Problems 13-14, 13-16); outside quotations vs. internal quotations (Problems 13-17, 13-21); Consideration of Opportunity cost (Problem 13-22); Fixing goal congruence price (Problems 13-4, 13-18, 13-23, 13-24, 13-25, A 97, A 99, A 130)

Return on Capital Employed—P13-1, 13-2, 13-3, 13-8, 13-9, 13-10

Return on Networth—P13-5

Return as a percentage on selling price—P13-6

Transfer Pricing—P13-4, 13-11, 13-13, 13-16, 13-17, 13-18, 13-21, 13-23, 13-24, 13-25, A145

Costplus Transfer Pricing—P13-12

Alternative Transfer Pricing—P13-14, 13-26

Contribution Approach to Transfer Pricing—P13-15, 13-20, 13-22 A 99

Optimal Pricing—A 130

Miscellaneous—P13-7, A 97

Costing and Inflation*

Current Cost Accounting

Problem 14.1. The Balance Sheets of S Ltd. at 31st December 1983 and 31st December 1984 were as follows :

	31st Dec. 1983 (Rs. '000)	31st Dec. 1984 (Rs. '000)
Land and buildings (Cost Rs. 160)	152	148
Equipment (Cost Rs. 100)	50	40
Stock	30	40
Debtors	13	28
Bank	(10)	14
	<hr/> 235 <hr/>	<hr/> 270 <hr/>
Equity Shares	150	150
Reserves	60	70
Debentures 10%	—	20
Creditors	10	15
Proposed Dividend	15	15
	<hr/> 235 <hr/>	<hr/> 270 <hr/>

The Profit and Loss Account for the year ended 31st December 1984 was :

	(Rs. '000)	(Rs. '000)
Sales		100
Opening Stock	30	
Purchases	61	
	<hr/> 91 <hr/>	
Less : Closing Stock	40	51
	<hr/> 49 <hr/>	<hr/> 49 <hr/>
Gross Profit		49
Expenses (including debenture interest)	10	
Depreciation—Building	4	
Depreciation—Equipment	10	24
	<hr/> 24 <hr/>	
Net Profit		25
Proposed Dividend		15
		<hr/> 10 <hr/>
Balance carried forward		10

* Relevant only to final level students of professional examinations.

The relevant price indices are :

(i) 1982 (average)—Date of Building acquisition	105
(ii) 1979 (average)—Date of equipment acquisition and issue of equity shares	80
(iii) 1983—last quarter average	114
(iv) 1984—(1st January)—debentures' issued	116
(v) 1984—(last quarter average)	122
(vi) 1984—(Average)	118
(vii) 1984—(31st December)	125

Closing stock of 1984 was acquired during whole of 1984 and opening stock during 1983. Required :

S Ltd. wishes to adjust its historic accounts to reflect current costs in line with 'Current Cost Accounting' (CCA) method. Assuming that the "Value to the business" of the assets is given by the price indices above, prepare the accounts on a current cost basis showing current cost adjustments for the year ended 31st December 1984 under the following heads :

(a) Cost of Sales ; (b) Depreciation, (c) Monetary working capital ; and (d) Gearing. [I.C.W.A. (Final), June 1987]

Solution.

[Note : Adjustments required are in line with SSAP 16 of the Institute of Chartered Accountants in England and Wales]

Step. 1 Adjustments (Rs. '000)

(i) Cost of Sales Adjustments (COSA)	
Increase in stock holding (40—30)	10.00
Increase in stock holding at average current cost	
$40 \times (118 \div 125) - 30 \times (118 \div 116) = 37.8 - 30.5$	7.3
	<u>2.7</u>

Current cost value at which closing stock has to be shown in B/S based on CCA.

$$40 \times (125 \div 118) \quad 42.4$$

(ii) Depreciation Adjustments

Depreciation charge for the year	
Building $4 \times (125 \div 105)$	= 4.8
Equipment $10 \times (125 \div 80)$	= 15.6
	<u>20.4</u>

Adjustment to historic depreciation is Rs. 6.4 (i.e., (Rs.20.4—Rs. 14).

Current cost value at which fixed assets have to be shown in B/S based on COSA :

$$\begin{aligned} \text{Building } 148 \times (125 \div 105) &= 176.2 \\ \text{Equipment } 40 \times (125 \div 80) &= 62.5 \end{aligned}$$

$$\underline{\underline{238.7}}$$

\therefore Fixed assets replacement reserve = Rs. 238.7—Rs. 188 = 50.7.

(iii) *Monetary Working Capital adjustment*

Working capital at historic cost {28-15}--{13-10}	10.0
Increase in MWC at average current cost {13-((118+125)/2)}--{3×((118+116)/2)}	9.2
MWC Adjustment	<u>0.8</u>

(iv) *Gearing Adjustment : (As per CCA method)*

Cost of Sales Adj.	2.7
Depreciation Adj.	6.4
MWC Adj.	0.8
Total Current Cost Adj.	<u>9.9</u>

Net Operating Assets

Fixed Assets	188
Stock	40
Net Monetary Working Capital	13
	<u>241</u>

Net Borrowings -

Debenture	20
Less : Bank	14
	<u>6</u>

Gearing $9.9 \times (6 \div 241) = 0.3$ (v) *Current Cost Reserve*

Current Cost Adj. less gearing adjustment	9.6
Fixed Assets replacement Reserve (238.7-188)	50.7
Stock Replacement Reserve	2.4
	<u>62.7</u>

Trading and P & L A/c based on CCA

Profit on historical cost basis	25.0
Less : Current cost operating Adj.) 2.7 + 6.4 + 0.8	9.9
Current cost Profit	<u>15.1</u>
Add : Gearing Adjustment	<u>0.3</u> (Refer to Note (ix))

Current cost profit attributable to shareholders	15.4
Proposed dividend	15.0
	<hr/>
Transfer to Reserve	0.4
	<hr/>

Balance Sheet as at 31st Dec. 1984 based on COSA.

Equity Shares		150.0
Opening Reserve	60.0	
Addition to Reserve as per CCA	0.4	
	<hr/>	60.4
Current Cost Reserve		62.7
		<hr/>
		273.1
		<hr/>
Land (Net) $148 \times (125 \div 105)$		176.2
Equipment (Net) $40 \times (125 \div 80)$		62.5
Stock $[40 \times (125 \div 118)]$	42.4	
Debtors (No Adj.)	28.0	
Bank (No Adj.)	14.0	
	<hr/>	84.4
Less : Creditor (No Adj.)	15.0	
Dividend (, ,)	15.0	
Debenture	20.0	50.0
	<hr/>	<hr/>
		34.4
		<hr/>
		273.1
		<hr/>

Inflation Accounting and B.E. Point

Problem 14.2. In the year ended 31st December 19 \times 5 the actual costs, output, and sales of a company manufacturing a range of products were as follows :

	Product			
	A	B	C	D
Per unit :				
Selling price	Rs. 20	Rs. 40	Rs. 50	Rs. 30
Variable costs :				
Direct materials	4	9	10	3
Direct wages	3	5	10	4
Manufactured and sold units	7,500	5,000	3,000	6,000

Variable overhead was incurred at a rate of 200% of direct wages.

Fixed overhead was Rs. 2,00,000 for the year.

The company's summarised budgeted results for the year ended 31st December 19×5 were :

Sales	Rs. 7.00,000
Variable cost of sales	4,55,000
Contribution	2,45,000
Fixed overhead	1,90,000
Budgeted profit	55,000

In preparing its budget for the year ending 31st December 19×6 the company has made the following allowances for inflation over the actual figures for 19×5.

- (i) An increase in all selling prices of 10% ; these increases are not expected to alter the quantities of each product sold, as compared with 19×5.
- (ii) An increase in unit product costs of :

	%
Direct materials	10
Direct wages	20
Variable overhead	10
- (iii) An increase of 2% in fixed overhead.

In addition to those allowances for inflation, the company proposes the following changes in its cost, sales volume, and selling price structure :

- Product A Increase the price by 10% yielding a reduction of 5% in volume sold.
- Product B Use different direct materials which will reduce direct materials cost by Rs. 2 per unit and reduce volume sold by 4%.
- Product C (i) Incur advertising cost of Rs. 10,000 for the year which is expected to increase sales by 20%.
 (ii) Buy a machine costing Rs. 8,000 which would reduce direct labour hours by 20% for the same grades of labour.
- Product D Reduce the selling price by 10%, giving an increase in sales volume of 15%.

Increase stocks held by an average of Rs. 40,000 over the whole year ; this would be financed by bank overdraft at an interest rate of 12% per annum.

Increase the size of the delivery van fleet at an outlay of Rs. 9,000 and an increase in annual fixed costs of Rs. 2,000 (excluding depreciation).

The company calculates its depreciation on a straight-line basis with a standard life of five years for production equipment and three years for non-production equipment.

You are required :

(a) To show, in a format helpful to management, a summary statement of the budgeted and actual results for the year ended 31st December 19×5 with an analysis of the difference between the two profits.

(b) To compile a budgeted profit and loss account for the company for the year ending 31st December 19×6 after taking account of :

(i) allowances for inflation only.

(ii) allowances for inflation and the additional changes proposed.

(c) To calculate the separate break-even points for the actual results of the year ended 31 December 19×5 and budget for 1976 at (b) (ii) above.

(d) To comment very briefly on :

(i) the differences between the results of (b) (i) and (b) (ii) above ;

(ii) the implications for the company of the results of (c) above.

(C.I.M.A. London 1985 – Adapted)

Solution.

1. Working Details of actual results for the year ended 31st Dec. 19×5

	A	B	C	D	Total
Units	7,500	5,000	3,000	6,000	21,500
Selling Price	Rs. 20	Rs. 40	Rs. 50	Rs. 30	
Sales	1,50,000	2,00,000	1,50,000	1,80,000	6,80,000

Variable Cost :	Unit	Total	Unit	Total	Unit	Total	Unit	Total
				Rs.		Rs.		Rs.
Material	4	30,000	9	45,000	10	30,000	3	18,000
Wage	3	22,500	5	25,000	10	30,000	4	24,000
Overhead	6	45,000	10	50,000	20	60,000	8	48,000
Total V.O.H.		97,500		1,20,000		1,20,000		90,000

2. Allowance for inflation

	A	B	C	D	Total
	Rs.	Rs.	Rs.	Rs.	Rs.
Sales (10% increase)	1,65,000	2,20,000	1,65,000	1,98,000	7,48,000
Variable Costs :					
Material (plus 10%)	33,000	49,500	33,000	19,800	1,35,300
Labour (plus 20%)	27,000	30,000	36,000	28,800	1,21,800
Overhead (plus 10%)	49,500	55,000	66,000	52,800	2,23,300
	1,09,500	1,34,500	1,35,000	1,01,400	4,80,400

3. Allowances for inflation plus proposed changes

	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>Total</i>
Units	7,125	4,800	3,600	6,900	22,425
Selling Price	Rs. 24.20	Rs. 44.00	Rs. 55	Rs. 29.7	
Sales Revenue	1,72,425	2,11,200	1,98,000	2,04,930	7,86,555
	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>Total</i>
<i>Variable Cost</i>	<i>Per Unit</i>	<i>Per Unit</i>	<i>Per Unit</i>	<i>Per Unit</i>	<i>—</i>
Material	4.4 31,350	7.9 37,920	11.0 39,600	3.3 22,770	—
Labour	3.6 25,650	6.00 28,800	9.6 34,560	4.8 33,120	—
Overhead	6.6 47,025	11.00 52,800	17.6 63,360	8.8 60,720	—
	1,04,025	1,19,520	1,37,520	1,16,610	4,77,675

Fixed Overhead :

2,00,000

2% in inflation

4,000

2,04,000

Advertisement

10,000

Machine Rs. 8,000 ÷ 5

1,600

Interest Rs. 40,000 × 12%

4,800

Delivery Van Rs. 9,000 ÷ 3

3,000

Annual Increase

2,000

2,25,400

(a) Statement of results for the year ended 31st Dec. 1985

	<i>Budgeted results</i>	<i>Actual results</i>	<i>Variance</i>
Sales	Rs. 7,00,000	Rs. 6,80,000	Rs. 20,000 (A)
Variable Cost	(4,55,000)	(4,27,500)	27,500 (F)
Contribution	2,45,000	2,52,500	7,500 (F)
Fixed Cost	1,90,000	2,00,000	10,000 (A)
Profit	55,000	52,500	2,500 (A)

(b) Budgeted profit and loss account for the year ending 31st Dec. 1985

	<i>(i) Allowing for inflation only</i>	<i>(ii) Allowing for inflation and additional changes</i>
Sales	Rs. 7,48,000	Rs. 7,86,555
Less : Variable Cost	4,80,400	4,77,675

	2,67,600	3,08,880
Fixed Cost	2,04,000	2,25,400
	<u>63,600</u>	<u>83,480</u>
	=====	=====

(c) Break-even point

Fixed Cost	Rs. 2,00,000	Rs. 2,25,400
Contribution per unit		
(Rs. $2,52,500 \div 21,500$)	Rs. 11.744	
(Rs. $3,08,880 \div 22,425$)		Rs. 13.774
Break-Even point (Units)	17,030	16,364

(d) (i) The higher contribution generated by (ii) more than covers the rise in fixed costs resulting in higher profit. The changes suggested for product D do not increase its contribution and result in higher extra stock holding and delivery cost.

(ii) The break even point in 1986 is lower and the margin of safety is higher. This means that unit sales can fall by a higher percentage before a loss will be sustained.

Current Purchasing Power

Problem 14.3. (a) "Inflation is known to be beneficial to those who owe money and detrimental to those who are owed money"—Explain.

(b) In the context of Inflation Accounting System adjust the following Profit and Loss Account and Balance Sheet under the 'Current Purchasing Power' (or CPP) method to ascertain the changes in Net Profit and Reserve.

Profit and Loss Account for the year ended
31st December, 1984

		Rs. (000)
Sales		500
Opening Stock	80	
Purchases	420	
	<u>500</u>	
Less : Closing Stock	<u>70</u>	
		430
Gross Profit		70
Depreciation (buildings)	5	
Administration	25	30
	<u>30</u>	
Net Profit		<u>40</u>

Balance Sheet as at 31st December		Rs. (000)
Share Capital		200
Reserves		200
		<u>400</u>
Land		140
Building	200	
Depreciation	45	
	<u> </u>	155
Stock	70	
Debtors	40	
Cash	30	
	<u> </u>	140
Less : Creditors	35	105
	<u> </u>	<u>400</u>

The following data are given :

(1) Closing stock was acquired during last quarter of 1984 and opening stock during the last quarter of 1983.

(2) The land and buildings were acquired and the capital issued during 1976. The buildings are depreciated straight line over 40 years.

(3) The relevant retail price indices are

(a) 1976 average	60
(b) 1983 last quarter average	108
(c) 1983 December 31	110
(d) 1984 last quarter average	116
(e) 1984 average	114
(f) 1984 December 31	118

(4) Sales, Purchases and Administration expenses are assumed to occur evenly over the year and hence at average prices.

(I.C.W.A. Final, Dec 1986)

Solution. (a) Please refer to 'Advanced Cost Accounting' (now titled as Advanced Cost and Management Accounting—Text) by Saxena and Vashist.

(b) **Profit and loss for the period ended 31-12-84**

	Unadjusted	Factor	Adjusted to CPP basis at 31-12-1984
Sales	500	118/114	517.6
O' Stock	80	118/108	87.4
Purchases	420	118/114	434.7
	<u>500</u>		<u>522.1</u>

P14.10

COST AND MANAGEMENT ACCOUNTING

Less : C/Stock	70	430	118/116	71.2	450.9
	---	---		---	---
Gross Profit	70				66.7
Depreciation	5		118/60	9.8	
Administration	25		118/114	25.9	35.7
	---			---	---
Net Profit	40				31.0
	---				---

Balance Sheet as at 31-12-1984

	<i>Unadjusted</i>		<i>Factor</i>		<i>Adjusted to CPP</i>
Share capital	200		118/60		393.3
Reserve	200		Consequential figure		292.9
	---				---
	400				686.2
	---				---
Land	140		118/60		275.3
Building	200		118/60	393.3	
Dep.	45	155	118/60	88.6	304.7
	---			---	---
Stock	70		118/116	71.2	
Debtors	40		No change	40.0	
Cash	30		"	30.0	
	---			---	---
	140			141.2	
Less : Creditors	35	105	"	35.0	106.2
	---	---		---	---
	400				686.2
	---				---

Note : Solution is based on CPP method and not CCA requiring COSA, Depreciation, MWA and Gearing adjustment etc.

Inflation Accounting (Key Ratios)

Problem 14.4. The following abridged trading results and other data relate to Speedwell Limited for the past two years :

Year ended 31st October

	<i>1981</i>	<i>1982</i>
Production (Units)	40,000	50,000
Sales (Units)	40,000	45,000
	---	---

Sales		Rs. 8,00,000		Rs. 90,000
Direct Materials	Rs. 2,40,000		Rs. 3,30,000	
Direct Wages	2,00,000		2,75,000	
Variable Overheads	1,60,000		2,35,000	
Fixed Overheads	1,20,000		1,60,000	
	<u>7,20,000</u>		<u>10,00,000</u>	
Add : Opening				
Finished Goods	—		—	
Less : Closing				
Finished Goods	—		1,00,000	
		<u>7,20,000</u>		<u>9,30,000</u>
Net Surplus		Rs. 80,000		Rs. 90,000

Balance Sheet as at 31st October

	1981		1982	
Fixed Assets at Cost		Rs. 4,80,000		Rs. 5,50,000
Less : Depreciation		<u>1,30,000</u>		<u>1,80,000</u>
		3,50,000		3,70,000
Current Assets :	Rs.		Rs.	
Finished Goods	—		1,00,000	
Debtors	1,30,000		1,90,000	
Cash and Bank				
Balances	<u>10,000</u>		<u>—</u>	
	1,40,000		2,90,000	
Current Liability :				
Bank Overdraft	—		60,000	
Creditors	<u>50,000</u>		<u>70,000</u>	
	50,000		1,30,000	
		<u>10,000</u>		<u>1,60,000</u>
		4,40,000		5,30,000
Represented by :				
Share Capital		3,00,000		3,00,000
Reserves		<u>1,40,000</u>		<u>2,30,000</u>
		4,40,000		5,30,000

There were no Opening or Closing Stocks other than Finished Goods at 31st October 1982.

The following indices reflect price levels during the two years :

	1981	1982
Direct materials	100	110
Direct Wages	100	108
General Price Index	100	109

Required :

- Write a short report to management assessing the relative performance of the Company in 1981 and 1982. Your report should include a tabulation of key ratios and cost data and take into account the price indices given.
- The Company has asked you to revalue the closing stock of finished goods on a variable cost basis. Give the necessary calculation and explain its effect on trading results.

(I.C.W.A. Final, Dec. 1985)

Solution. (a) Report to management

(i) **Operation.** To assess the relative performance in times of inflation it is necessary to represent the 1981 operating figures at the 1982 price level using the indices shown. Opportunity has also been taken to reallocate the 1982 closing stock over costs of materials (Rs. 33,000) wages (Rs. 27,500), variable overheads (Rs. 23,500), and fixed overheads (Rs. 16,000) in order to show the trading results.

Profit and Loss Accounts

	Years ended 31st October					
	1981 (adjusted to 1982 level of prices)			1982		
Production (units)	40,000			50,000		
Sales (unit)	40,000			45,000		
	Rs.	Rs.	Rs. per unit	Rs.	Rs.	Rs. per unit
Sales ($\times 109 \div 100$)		8,72,000	21.80		9,90,000	22.00
Direct material ($\times 110 \div 100$)	2,64,000		6.60	2,97,000		6.60
Direct wages ($\times 108 \div 100$)	2,16,000		5.40	2,47,500		5.50
Variable overheads ($\times 109 \div 100$)	1,74,400	6,54,400	4.36	2,11,500	7,56,000	4.70
Contribution		2,17,600	5.44		2,34,000	5.20
Fixed overheads ($\times 109 \div 100$)		1,30,800			1,44,000	
Net surplus		86,800			90,000	
		=9.95% Sales			=9.1% Sales	

It is noticed that although sales volume has increased by 12.5% and sales value has increased by 13.5% the net surplus has increased by only 3.69% from Rs. 86,800 to Rs. 90,000. Also the new profit/sales ratio has decreased from 9.95% to 9.1%. All this indicates a reduction in overall operating efficiency.

There is a loss of contribution of Re. 0.24 per unit in 1982 compared with 1981 in spite of an increase in selling price of Re. 0.20 per unit. Whilst costs of materials used per unit have not changed, there has been a considerable decrease in efficiency in the use of direct wages (Re. 0.10 per unit up) and variable overheads (Re. 0.34 per unit up). Both of these need careful examination by the Works Director to identify reasons for the increased costs such as failure of staff handling or overhead control methods causing over use of resources or services. Remedial action may be necessary.

Whilst fixed overheads have increased in total from Rs. 1,30,800 to Rs. 16,000 it is noticed that Rs. 16,000 of this has been included in closing stock and will be carried forward to next year and will hopefully, be recouped then. As a result, there is an apparent improvement from Rs. 3.27 to Rs. 3.20 in fixed overheads costs per unit but this were charged in the same year against sales. The fixed overhead costs per unit sold would be Rs. 3.55.

(ii) Working capital use :

Stock : The new finished goods stock ties up scarce capital. If this resulted from a policy decision to hold stock in anticipation of known sales in 1983, the capital will recirculate through debtors, and bank in due course. If, however, the stock has arisen from an inability to sell, then there could be a drastic reduction in cash flow in the immediate future.

Debtors : 1981 debtor represent 1.95 month and 1982, 2.3 months. The rise needs examination. It may represent a decision to allow extra credit to increase sales but it may indicate a deterioration in debtor control and collection methods. The actual reasons must be sought.

Creditors : There is very little change between 1981 (2.5 months) and 1982 (2.54 month).

Acid test : (Ratio of current assets less stock to current liabilities) shows :

1981 Rs. 100,000 : Rs. 50,000	1982 Rs. 190,000 : Rs. 1,30,000
Or 2.8 : 1	Or 1.46 : 1

This ratio tests the ability of Speedwell Limited to repay its immediate debts. There is a considerable deterioration in the year which indicates future difficulty in settling commitments. The company has run up an overdraft of Rs. 60,000. This may be part of an arrangement with the bank to cover the increase in finished goods stock pending sale but it could indicate that the company is overtrading and short of ready funds. The immediate cash flow forecast needs to be examined. The company may require extra permanent capital.

(iii) Capital structure and assets

New assets have been obtained in the year tying up capital permanently. Company has no gearing there is no borrowed capital but in reality the company is using more short term funds (Rs. 80,000) in the form of creditors and overdraft. The debt/equity ratio shows this.

$\frac{\text{All debts including creditors and overdraft} \times 100}{\text{All debts} + \text{equity}}$	
1981	1982
$\frac{50,000 \times 100}{50,000 + 4,40,000} = 10.2\%$	$\frac{1,30,000 \times 100}{1,30,000 + 5,30,000} = 19.7\%$

(iv) Overall

The examination of the business operation shows poorer performance indicated by lower contribution per unit and efficient use of working capital. There could be liquidity problems looming if stock cannot be re-sold quickly—already overdraft if large. Permanent capital may be required.

(b) Closing stock

Value of stock on a variable cost basis will be

	Rs. per unit
Direct materials	6.60
Direct wages	5.50
Variable overheads	4.70
	<hr/>
Marginal cost	$16.80 \times 5000 \text{ unit}$ = Rs. 84,000

As a result of revaluing the stock, the net surplus will be reduced by Rs. 16,000 to Rs. 70,000. The whole of the Rs. 1,60,000 fixed costs will be charged against profits instead of Rs. 1,44,000.

Problem 14.5. The Balance Sheet of Pracheen and Naveen, a partnership firm as at 30th June, 1988 had the following assets and liabilities :

Assets	Rs.
Cash	5,00,500
Accounts receivable	9,50,000
Inventory (LIFO basis)	15,00,000
Prepaid Insurance	18,000
Land	58,000
Machinery and Equipment	14,73,500
	<hr/>
	45,00,000
	<hr/>

<i>Liabilities and Capital</i>	<i>Rs.</i>
Current Liabilities	14,75,000
Pracheen's Capital	18,15,000
Naveen's Capital	12,10,000
	<u>45,00,000</u>

Pracheen and Naveen are considering selling their business but are concerned that the financial statements do not reveal their current worth.

You have been requested to assist in determining the current value of the assets.

The following data are relevant :

1. An ageing Statement of Accounts Receivable disclosed the following :

<i>Accounting Year</i>	<i>Amount Rs.</i>	<i>Allowance for Doubtful Debts Rs.</i>
1984-85	40,000	35,000
1985-86	1,25,000	1,05,000
1986-87	1,60,000	67,500
1987-88	9,25,000	92,500
	<u>12,50,000</u>	<u>3,00,000</u>

A review of past experience shows that all receivables over two years old have been uncollectable those over one year old have been 50% collectable and those less than one year old have been 90% collectable.

2. The inventory price increases are :

<i>Accounting Year</i>	<i>Cost Rs.</i>	<i>PRICE INCREASES</i>	
		<i>Period</i>	<i>Increase</i>
<i>acquired</i>			
1983-84	60,000	1983-87	20%
1984-85	1,50,000	1984-87	18%
1985-86	2,40,000	1985-87	15%
1986-87	3,50,000	1986-87	11%
1987-88	7,00,000	1987-88	5%
	<u>15,00,000</u>		

The inventory has been valued on the LIFO basis and the cost of the LIFO layers at the average price for the indicated year of acquisition.

3. Machinery was purchased in accounting years 1983-84, 1985-86 1986-87 for Rs. 5,00,000, 8,50,000 and Rs. 6,60,000 respectively. The

straight line depreciation and a 10-year estimated life has been used for all machinery with a half-year of depreciation taken in the year of acquisition. The market conditions indicate that the machinery can be sold at 125% of its book value.

4. An independent appraisal made in June 1988 put the value of the land at Rs. 70,000. Prepare a comparative statement of assets showing historical costs and current values as at 30th June, 1988 with supporting schedules. (I.C.W.A. Final, June 1988)

Solution. Comparative Statement showing the historical cost and current values of assets.

	<i>Historical Cost</i>	<i>Current Value</i>
Cash	Rs. 500,500	Rs. 500,500
Accounts Receivable (Net)	9,50,000	9,12,500
Inventory	15,00,000	16,48,500
Prepaid Insurance	18,000	18,000
Land	58,000	70,000
Machinery and Equipment	14,73,500	18,41,875
	<u>45,00,000</u>	<u>49,91,375</u>

Working Notes :

Current Value of Accounts Receivable

<i>Year</i>	<i>Amount (Rs.)</i>	<i>Required Allowance</i>	<i>Current Value (Rs.)</i>
1984-85	40,000	100%	—
1985-86	1,25,000	100%	—
1986-87	1,60,000	50%	80,000
1987-88	9,25,000	90%	8,32,500
			<u>9,12,500</u>

Current Value of Inventory

<i>Year</i>	<i>Cost (Rs.)</i>	<i>Increase</i>	<i>Current Value (Rs.)</i>
1983-84	60,000	20%	72,000
1984-85	1,50,000	18%	1,77,000
1985-86	2,40,000	15%	2,76,000
1986-87	3,50,000	11%	3,88,500
1987-88	7,00,000	5%	7,35,000
			<u>16,48,500</u>

Current value of Plant and Equipment

$$\text{Rs. } 14,73,500 \times 1.25 = 18,41,875$$

Inflation Accounting (Backlog Depreciation)

Problem 14.6. (a) Define and explain the term "backlog depreciation" in the context of Inflation Accounting.

(b) Calculate the amount of depreciation under "Current Cost Accounting" (CCA) method for each of the four years as well as the backlog depreciation for a certain item of the asset from the following details :

Cost of machine	Rs. 40,000
Estimated life	4 years
Residual value	Nil
Inflation factor	10% p a.

Assume straight line method of depreciation

(ICW.A. Final, June 1988)

Solution. (a) Please refer to "Advanced Cost and Management Accounting—Text" b) Saxena and Vashist.

(b) Year	Historical cost (Rs.)	Replacement cost (Rs.)	Depreciation on H.C. Rs.	R.C. Rs.	Additional Depreciation (CCA Adjustment) Rs.
1	40,000	44,000	10,000	11,000	1,000
2	40,000	48,400	10,000	12,100	2,100
3	40,000	53,240	10,000	13,310	3,310
4	40,000	58,564	10,000	14,641	4,641
			40,000	51,051	11,051

Calculation for Backlog Depreciation

Year	Total Depreciation on		Total Depreciation	Addl. Annual Depreciation (Rs.)
	H.C. (Rs.)	R.C. (Rs.)	Rs.	
1	10,000	11,000	1,000	1,000
2	20,000	24,200	4,200	3,200 (4,200—1,000)
3	30,000	39,980	9,980	5,730 (9,980—4,200)
4	40,000	58,564	18,564	8,634 (18,564—9,980)
				18,564

<i>Year</i>	<i>Addl. Dep.</i>	<i>CCA Depr. Adjustment</i>	<i>Backlog Depreciation</i>
1	Rs. 1,000	Rs. 1,000	Nil
2	3,200	2,100	1,100
3	5,730	3,310	2,420
4	8,634	4,641	3,993
	<u>18,564</u>	<u>11,051</u>	<u>7,513</u>

Price Level Adjusted Balance Sheet (Monetary Gain)

Problem 14-7 The balance sheets (at the beginning and close of the year) and income statement of a company under historical cost basis are as follows :—

Comparative Balance Sheets

	January 1	31st December
Cash	Rs. 60,000	Rs. 28,500
Debtors	75,000	2,46,750
Stock	1,26,000	2,55,000
Land	50,000	50,000
Plant	2,34,000	2,34,000
Less : Depreciation	(78,000)	(84,600)
Total assets	<u>4,67,000</u>	<u>7,29,650</u>
Creditors	1,20,000	3,16,500
10% long term loan (mortgage of land)	50,000	50,000
Shareholders funds	<u>2,97,000</u>	<u>3,63,150</u>
Total liabilities	<u>4,67,000</u>	<u>7,29,650</u>

Income Statement for the year ending 31st December :

Sales (Credit + Cash)		Rs. 3,32,500
Less : Cost of Goods sold	Rs. 2,64,000	
Interest (paid on December 31)	Rs. 5,000	
Other Cash Expenses	Rs. 2,000	
Depreciation	Rs. 6,600	
	<u>Rs. 2,77,600</u>	
Net income		<u>Rs. 54,900</u>

The Company uses the *FIFO* method of stock costs.

General price index for the various relevant periods in as follows :—

July 1, 12 years ago	50
January 1, 2 years ago	150
January 1, Current Year	200
December 31, Current Year	250

Transactions are assumed to have occurred evenly throughout the year at an average price level of 225. Plant was purchased on 1st July, 12 years ago and land was acquired on January 1, two years ago. You are required to prepare

- Price level adjusted income statement
- Price level adjusted balance sheets at the opening and closing of the year.

The balancing figure on the liability side of the price level adjusted balance sheets may be assumed to be as monetary gain. (ICWA Dec. 1988)

Solution. (a) Price level adjusted income statement for the current year.

	Historical Cost	Conversion factor	Adjusted amount
Sales	Rs. 3,32,500	250/225	Rs. 3,69,444
Less : Cost of Goods sold			
(a) Beginning	1,26,000	250/200	1,57,500
(b) Out of current purchase			
(Rs. 2,64,000 — Rs. 1,26,000)	1,38,000	250/225	1,53,333
Interest	5,000	250/250	5,000
Other cash expenses	2,000	250/225	2,222
Depreciation	6,600	250/50	33,000
Net Income	54,900		18,389

(b) (i) Price level adjusted balance sheet (opening) expressed in terms of the current value of money

Assets

Cash	60,000	250/200	75,000
Debtors	75,000	250/200	93,750
Stock	1,26,000	250/200	1,57,500
Land	50,000	250/150	83 3 3
Plant	2,34,000	250/50	11,70,000
Less Depreciation	(78,000)	50/50	(3,90,000)
	4,57,000		11,89,583

Liabilities

Creditors	1,20,000	250/200	1,50,000
10% long term loan	50,000	250/150	83,333
Shareholders Fund	2,97,000	250/200	3,71,250
Monetary gain (balancing figure)	—		5,85,000
	<u>4,67,000</u>		<u>11,89,583</u>

(ii) Price level adjusted balance sheet (closing), expressed in terms of the current value of money.

	Historical	Conversion factor	Adjusted amount
Assets			Rs.
Cash	Rs. 28,500	250/250	28,500
Debtors	2,46,750	250/250	2,46,750
Stock	2,55,000	250/225	2,83,334
Land	50,000	250/150	83,333
Plant	2,34,000	250/50	11,70,000
Less Depreciation	(84,600)	250/50	(4,23,000)
Total assets	<u>7,29,650</u>		<u>13,88,917</u>

Liabilities	Historical Cost	Conversion factor	Adjusted amount
Creditors	Rs. 3,16,500	250/250	Rs. 3,16,500
10% long term loan	50,000	250/250	50,000
Shareholders Fund			
Opening :	2,97,000	250/200	3,71,250
Add Profit	54,900	—	18,389
Add additional capital issued (Rs. 3,63,150 — Rs. 2,97,000 - Rs. 54,900)	11,250	250/225	12,500
Monetary gain : Opening			
5,85,000	—		
Add addition during the year	35,278		
(balancing figure)			6,20,278
	<u>7,29,650</u>		<u>13,88,917</u>

Problem 14-8. (R.O.C.E. on replacement Costs) Rising Ltd. is a company that was established in 1984 is in the grip of rising prices. It depreciated its plant and machinery by the reducing balance method, charging 33 $\frac{1}{3}$ % of the reducing balance each year. All fixed assets can be assumed to have been purchased at the beginning of the year in which they are acquired.

Capital employed is taken at the year-end value. Details of the company's capital employed and profit are as follows :

<i>Plant and machinery</i>		<i>Working Capital</i>	<i>Profit before depreciation</i>
<i>Year of Purchase</i>	<i>Cost</i>	<i>at year-end</i>	
	<i>Rs. ('000)</i>	<i>Rs. ('000)</i>	<i>Rs. ('000)</i>
1984	324		
1985	81		
1986	54	130	142

The replacement cost of plant and machinery has been given and the price index for plant and machinery costs is as follows:

<i>End of</i>	<i>Index</i>
1983	244.8
1984	260.1
1985	275.4
1986	306.0

Required :

Calculate Rising Limited's Return on capital employed using :

- Historical cost and net book values to value fixed assets
- Replacement costing for fixed assets values and depreciation.

(I.C.W.A. Final, December 1987)

Solution. (a) Statement showing historical Cost and net book values

<i>Year of Purchase</i>	<i>Cost</i>	<i>Depreciation</i>			<i>Accumulated Depreciation at end of 1986</i>	<i>(Rs. '000) Net Book value as on 31-3-1986</i>
		<i>Rs. '000</i>				
		1984	1985	1986		
1984	324	108	72	48	228	96
1985	81	—	27	18	45	36
1986	54	—	—	18	18	36
	<u>459</u>	<u>108</u>	<u>99</u>	<u>84</u>	<u>291</u>	<u>168</u>

Return on Capital employed :

Plant & Mach. (Net Book Value)	Rs. 1,68,000
Working Capital	1,30,000
Total Capital employed	2,98,000
Profit before depreciation	1,42,000
Less : Depreciation	84,000
	<u>58,000</u>
	<u>=====</u>

$$\text{R.O.C.E.} = (58,000 \div 2,98,000) \times 100 = 19.5\%$$

(b) Statement showing Depreciation and assets values at replacement cost.

Year of Purchase	Adj. Factor	Depreciation		Assets value (Rs. '000)	
		Historical Cost	Replacement Cost	Historical Cost	Replacement Cost
1984	306/244.6	48	60.0	96	120.0
1985	306/260.1	18	21.2	36	42.4
1986	306/275.4	18	20.0	36	40.0
		84	101.2		202.4
Capital Employed				(Rs. '000)	
Plant and Mach. at replacement cost				202.4	
Working Capital				130.0	
				332.4	
Profit before depreciation				142.0	
Less : Depreciation based on replacement cost				101.2	
				40.8	

$$\text{Return on Capital Employed} = (40.8 \div 332.4) \times 100 = 12.27\%.$$

Comment. It should be noted that return on capital employed based on replacement cost is lower than the return on capital employed based on historical cost. This is due to inflation.

Problems 14.9. (a) Explain under CCA method what is meant by

- Cost of Sales Adjustment
- Monetary Working Capital Adjustment

(b) Following data relate to Gearings Ltd:

	Rs '000	
	Beginning of the year	End of the year
Net Long Term Borrowings	14,000	14,000
Creditors	4,000	2,800
Bank Overdraft	5,000	5,600
Taxation	1,500	1,400
Cash	<u>(5,000)</u>	<u>(8,400)</u>
	19,500	15,400
(ii) Share Capital & Reserves		
from Current Cost Balance Sheet	37,080	47,056
Proposed Dividend	<u>500</u>	<u>600</u>
Total Shareholders' Interest	<u>37,580</u>	<u>47,656</u>

(iii) Current Cost Adjustment

Depreciation	1,700
Fixed Assets Disposal	1,800
Cost of Sales Adjustment	1,620
Monetary Working Capital Adjustment	<u>1,120</u>
	<u>6,240</u>

Find out :

(i) Gearing Adjustment Ratio.

(ii) Current Cost Adjustment after abating gearing adjustment.

(ICWA Final June 1989)

Solution (a) Please refer to "Advanced Cost and Management Accounting — Text" by Saxena and Vashist.

	Rs. '000	
	Opening	Closing
(b) (i) Net borrowings the average of which = L	19,500	15,400
Total Shareholders' interest the average of which = S	37,580	47,656
Total, the average of which = L + S	57,080	63,056
Gearing Adjustment Ratio :		
$= \frac{(19,500 + 15,400) + 2}{(57,080 + 63,056) + 2} \times 100 = 29.1\%$		

	Rs. '000
(ii) Total Current Cost Adjustment	6,240
Less: Gearing Adjustment (29.1% of above)	<u>1,815</u>
Current Cost Reserve after abating gearing adjustment	<u>4,425</u>

Please also refer to the Examples 18.1 to 18.6 of the book "Advanced Cost and Management Accounting — Text" by Saxena and Vashist.

Mathematical/Statistical Applications to Managerial Problems*

[Learning Curve 15.1—15.4, and 15.15 Expected Value and Probability
(Uncertainty) 15.5—15.25, Others 15.26—15.38]

Learning Curve

Problem 15.1. (a) The usual learning curve model is

$$Y = ax^b \text{ where}$$

Y is the average time per unit for x units

a is the time for first unit

x is the cumulative number of units

b is the learning coefficient and is

$$\text{equal to } \frac{\log 0.8}{\log 2} = -0.322 \text{ for a learning rate of } 80\%.$$

Given that $a = 10$ hours and learning rate is 80% you are required to calculate :

(i) the average time for 20 units

(ii) the total time for 30 units

(iii) the time for units 31 to 40.

Given that $\log 2 = 0.301$, Antilog of $0.5811 = 3.812$.

$\log 3 = 0.4771$ Antilog of $0.5244 = 3.345$.

$\log 4 = 0.6021$, Antilog of $0.4841 = 3.049$.

(b) Enumerate the uses of Learning Curve.

(I.C.W.A. Final, June 1987)

Solution.

$$Y = ax^b$$

Y = average time per unit for x units

a = time for first unit

x = cumulative number of units

b = learning coefficient

$$80\% \text{ level} = -0.322$$

(i) Average time for 20 units

$$a = 10 \text{ Hrs.}, \quad x = 20, \quad b = -0.322 \quad Y = 10 \times (20)^{-0.322}$$

taking logarithms of both sides.

$$\log Y = \log 10 - (0.322) \log 20$$

$$= 1 - (0.322) (1.301)$$

$$= 1 - 0.4189$$

* This chapter is relevant to I.C.W.A. (Final)/CIMA students only.

$$\log Y = .5811$$

Taking Antilog of both sides

$$\text{Antilog} (\log Y) = \text{Antilog} (.5811)$$

$$Y = 3.812.$$

So average time taken for 20 units = 3.812 hrs. per unit

(ii) *Total time for 30 units.*

Average time for 30 units :

$$Y = ax^b$$

$$Y = 10 \times 30^{-0.322}$$

Taking logarithm of both sides

$$\log Y = \log 10 - (0.322) (\log 30)$$

$$= 1 - (0.322) (1.4771)$$

$$= 1 - 0.4756$$

$$\log Y = 0.5244$$

Taking Antilog of both sides

$$\text{Antilog} [\log Y] = \text{Antilog} (.5244)$$

$$Y = 3.345$$

So average time taken for 30 units = 3.345 Hrs.

$$\text{Total time taken} = 3.345 \times 30$$

$$= 100.35 \text{ Hrs.}$$

(iii) *The time for units 31 to 40.*

We already know total time taken for 30 units. By calculating the total time taken for 40 units and then subtracting from it, time taken for 30 units, the remaining time will be that of producing 31 to 40 units.

Total time for 40 units :—

Average time for 40 units

$$Y = ax^b$$

$$Y = 10 \times 40^{-0.322}$$

Taking log of both sides

$$\log Y = (\log 10) - (.322) (\log 40)$$

$$= 1 - (.322) (1.6021)$$

$$= 1 - .5159$$

$$\log Y = 0.4841$$

Taking Antilog of both sides

$$\text{Antilog} (\log Y) = \text{Antilog} (.4841)$$

$$Y = 3.049$$

Average time for 40 units = 3.049 Hr.

Total time for 40 units = 121.96 Hr.

Time for units 31 to 40

Total time for 40 units = 121.96 Hrs.

Total time for 30 units = 100.35 Hrs.

Time for 31—40 units 21.61 Hrs.

(b) Please refer to *Advanced Cost Accounting* (now titled *Advanced Cost and Management Accounting—Text*) by Saxena and Vashist.

Learning Curve

Problem 15.2. The learning curve as a management accounting technique has now become or going to become an accepted tool in industry, for its applications are almost unlimited. When it is used correctly, it can lead to increased business and higher profits; when used without proper knowledge, it can lead to lost business and bankruptcy. State precisely :

- (i) your understanding of the learning curve ;
- (ii) the theory of learning curve ;
- (iii) the areas where learning curves may assist in management accounting ; and
- (iv) illustrate the use of learning curves for calculating the expected average unit cost of making.
 - (a) 4 machines
 - (b) 8 machines

using the data below :—

Data :

Direct labour needed to make first machine 1000 hours

Learning curve = 90%

Direct labour cost Rs. 15' per hour

Direct materials cost Rs. 1,50,000

Fixed cost for either size orders — Rs. 60,000

(I.C.W.A. Final, Dec. 1985)

Solution : (i) to (iii) Please refer to *Advanced Cos. Accounting* (now titled *Advanced Cost and Management Accounting—Text*) by Saxena and Vashist.

(iv) **Learning Curve (90%) for calculating the expected average unit cost**

Cumulative order size	Cum. Avg. hours	Cum. Avg. labour cost @ Rs. 15 per hr.	Materials	Overheads	Total
1	1,000	Rs. 15,000	—	—	—
2	(90% of 1000) = 900	13,500	—	—	—
(a) 4	(90% of 900) = 810	12,150	1,50,000	60,000	2,22,150
b) 8	(90% of 810) = 729	10,935	1,50,000	30,000	1,90,935

Preparing a bid using learning curve analysis

Problem 15.3. A customer has asked your company to prepare a bid on supplying 800 units of a new product. Production will be in batches of 100 units. You estimate that costs for the first batch of 100 units will average Rs. 100 a unit. You also expect that a 90% learning curve will apply to the cumulative labour cost on this contract.

Required : (a) Prepare an estimate of the labour costs of fulfilling this contract.

(b) Estimate the incremental labour cost of extending the production run to produce an additional 800 units.

(c) Estimate the incremental labour cost of extending the production run from 800 units to 900 units.

Solution : (a) Average cost decreases by 10 per cent every time the cumulative production doubles. Therefore.

Average cost of first 200 units = $0.9 \times$ Avg. cost of 100 units

Average cost of first 400 units = $0.9 \times$ Avg. cost of 200 units

Average cost of first 800 units = $0.9 \times$ Avg. cost of 400 units

Combining these, we find that average cost of the first 800 units
 $= 0.9 \times 0.9 \times 0.9 \times \text{Rs. } 100 = \text{Rs. } 72.90$

Total cost = $800 \times \text{Rs. } 72.90 = \text{Rs. } 58,320$

(b) Average cost of the first 1600 units = $0.9 \times \text{Rs. } 72.9 = \text{Rs. } 65.61$

\therefore Total cost of 1600 units = $1600 \times \text{Rs. } 65.61 = \text{Rs. } 1,04,976$

Additional cost of 2nd 800 units

= $\text{Rs. } 1,04,976 - \text{Rs. } 58,320 = \text{Rs. } 46,656$ or $\text{Rs. } 58.32$ per unit

(c) Because this increase will not increase cumulative production to twice of some figure we already have, formula has to be used :

$Y = ax^b$ where $b = 0.458 \div 0.301 = -0.15216$

$\log ax \text{ cost} = \log 10,000 - 0.15216 \log 9$

$= 4 - 0.1452 = 3.8548$

Average cost = $\text{Rs. } 71.5833$ per unit

Total cost = $900 \times 71.5833 = \text{Rs. } 64,425$

Incremental Cost = $\text{Rs. } 64,425 - \text{Rs. } 58,320 = \text{Rs. } 6,105$

or $\text{Rs. } 61.05$ per unit

Learning Curve (Fill in the blanks)

Problem 15.4. XYZ & Co. has given the following data :
 80% Average — Time Curve

Cumulative Units (x)	Average Hours	Total Hours	Marginal Hours
1	100	100	100
2	80	160	60
3	?	?	?
4	64	256	?

Required : Fill in the blanks

(I.C.M. A. London, May 1983)

Solution.

We know that : $Y = ax^b$

where Y = average time per unit

a = total time for the first unit

x = the cumulative number of units manufactured

b = the learning index

The learning coefficient, b , is determined as follows :

$$\begin{aligned} b &= \frac{\log (1 - \% \text{ decrease})}{\log 2} \\ &= \frac{\log (1 - 0.20)}{\log 2} = \frac{\log 0.80}{\log 2} \\ &= \frac{9.90309 - 10}{0.3010} = -0.322 \end{aligned}$$

By inserting the proper values into the equation, average time for any given number of units can be computed. For three cumulative units, we find that

$$\begin{aligned} Y &= 100 (3)^{-0.322} = 100 \cdot \frac{1}{3^{0.322*}} \\ &= 100 \cdot \frac{1}{1.4244} = 100 (0.7020) \text{ or } 70.2 \end{aligned}$$

* Log 3 = 0.47712

0.32349

0.15363 Antilog = 1.4244

Now it is possible to complete the table :

80% Average-Time Curve

Cumulative Units	Average Time	Total Time	Marginal Time
1.....	100	100	100 (100-0)
2.....	80	160 (80 × 2)	60 (160-100)
3.....	70.2	210.6 (70.2 × 3)	50.6 (210.6-160)
4.....	64	256 (64 × 4)	45.4 (256-210.6)

Each of the values in the table can be determined by means of the formulas :

Units	Average Time $= ax^b$
1.....	$100 (1)^{-.322} = 100 \cdot \frac{1}{1.322} = 100$
2.....	$100 (2)^{-.322} = 100 \cdot \frac{1}{2.322} = 80$
3.....	$100 (3)^{-.322} = 100 \cdot \frac{1}{3.322} = 70.2$
4.....	$100 (4)^{-.322} = 100 \cdot \frac{1}{4.322} = 64$

Units	Total Time $= ax^{b+1}$
1.....	$100 (1)^{-.322+1} = 100 (1)^{.678} = 100$
2.....	$100 (2)^{-.322+1} = 100 (2)^{.678} = 160$
3.....	$100 (3)^{-.322+1} = 100 (3)^{.678} = 210.6$
4.....	$100 (4)^{-.322+1} = 100 (4)^{.678} = 256$

Marginal Time $= a(b+1)x^b$		
Units	Formula (continuous)	(From Table above)
1	$100 (-.322+1) (1)^{-.322} = 100 (.678) 1 \div 1.322 = 67.8$	100
2	$100 (-.322+1) (2)^{-.322} = 100 (.678) 1 \div 2.322 = 54.2$	60
3	$100 (-.322+1) (3)^{-.322} = 100 (.678) 1 \div 3.322 = 47.6$	50.6
4	$100 (-.322+1) (4)^{-.322} = 100 (.678) 1 \div 4.322 = 43.4$	45.4

Probabilistic stock holding

Problem 15.5. A dealer of a perishable product earns a profit of Rs. 3 per kg. if he can sell within two days, but incurs a loss of Rs. 2 per kg. if fails to do so. The estimated demand for the product and the relative probabilities are as given below :

Estimated Demand	Probability
0 kg.	5%
1 „	20%
2 „	40%
3 „	25%
4 „	10%

In order to maximise his profit, what should be the quantity of stock that he should hold ?

(I.C.W.A. Final, June 1987)

Solution. Logic. Taking a hypothetical quantity of x units in stock at a time, the probability of profit of Rs. 3 x units will be the sum total of probabilities of all the event when demand is greater than x because in all the cases he can dispose of his stock. And probability of loss will be all the events when demand is less than x but here loss will be different at all levels. For while demand is one short of x ; his loss will be 2, if demand is two short of x his loss will be 4 and so on.

Stock level (kg.)	Expected Profit			Expected Loss			Net Profit (loss) (a) — (b)
	Profit	Prob.	Exp. Profit (a)	Loss	Prob.	Exp. Loss (b)	
0	—	—	—	—	—	—	0
1	3	.95	2.85	2	.05	.1	2.75
2	6	.75	4.50	4	.05	.2	
				2	.2	.4	
			4.50			.6	3.9
3	9	.35	3.15	6	.05	.3	
				4	.2	.8	
				2	.4	.8	
			3.15			1.9	1.25
4	12	.1	1.20	8	.05	.4	
				6	.2	1.2	
				4	.4	1.6	
				2	.25	.5	
			1.20			3.7	(2.5)

Therefore, optimum size is 2 kg.

Use of probability for accepting or rejecting a contract

Problem 15.6. An Engineering Company has been offered a one-year contract to supply a motor car component XY at a fixed price of Rs. 8 per unit. Its normal capacity for this type of component is 25,000 units a year. The estimated costs to manufacture are shown below. These costs are considered to be firm except for the direct material price.

Cost Data :

Variable Costs per unit :

Direct Wages	Rs. 1.50
Direct Material	2.25
Direct Expenses	0.65

Semi-Variable Costs per annum :

	<i>Output levels</i>		
	80%	100%	120%
Indirect Wages	Rs. 15,400	Rs. 16,000	Rs. 23,100
Indirect Materials	8,600	9,000	9,900
Indirect Expenses	2,000	2,500	3,000
Fixed Costs per annum :			Rs.
Supervisory Salaries	...	...	10,000
Depreciation	...	...	4,000
Other Overheads	...	...	16,000

You are required to :

(a) Calculate the cost and profit per unit and total annual profit assuming that the customer's orders in the year total :

- (i) 20,000 components or
- (ii) 25,000 components or
- (iii) 30,000 components, and that direct material is Rs. 2.25 per unit.

(b) Calculate the estimated profit for the year if it is assumed that the probability of the total order is:

- 0.3 for 20,000 components ;
- 0.6 for 25,000 components ;
- 0.1 for 30,000 components ;
- and that for direct material is :
- 0.5 for Rs. 2.25 per unit ;
- 0.3 for Rs. 2.50 per unit ;
- 0.2 for Rs. 2.75 per unit. (*I.C.W.A. Final, June 1987 — Adapted*)

Solution. (a) Profitability Statement

<i>Size of order</i>	20,000	25,000	30,000
Capacity	80%	100%	125%
Sales value	Rs. 1,60,000	Rs. 2,00,000	Rs. 2,40,000
<i>Less : Variable cost</i>			
(1.50 + 2.25 + 0.65) = Rs. 4.4 (i)	88,000	1,10,000	1,32,000
<i>Semi-Variable Cost :</i>			
Indirect wages	15,400	16,000	23,100
Indirect material	8,600	9,000	9,900
Indirect expenses	2,000	2,500	3,000
(ii)	26,000	27,500	36,000

Fixed Cost :

Supervisory salary	10,000	10,000	10,000
Depreciation	4,000	4,000	4,000
Other overhead	16,000	16,000	16,000
	<u>(iii) 30,000</u>	<u>30,000</u>	<u>30,000</u>
Total Cost (i)+(ii)+(iii)	<u>1,44,000</u>	<u>1,67,500</u>	<u>1,98,000</u>
Total profit	16,000	32,500	42,000
Cost per unit	7.20	6.70	6.60
Profit per unit	0.80	1.30	1.40

(b) Expected size of order.

size × Probability	
20,000 × .3	= 6,000
25,000 × .6	= 15,000
30,000 × .1	= 3,000
	<u>24,000 units</u>

Expected price of material

Price × Prob.	
2.25 × 0.5	= 1.125
2.5 × 0.3	= 0.75
2.75 × 0.2	= 0.55
	<u>2.425</u>

Profitability Statement for Order Size of 24,000 Units

Sales volume (24,000 × 8)		1,92,000
Cost		
Variable cost @: 4.575 (1.5 + 2.425 + 0.65)	(a)	1,09,800
Semi-variable cost :		
Indirect Wages Rs. 15,400 + (4/5 × Rs. 600)	15,880	
Indirect Material Rs. 8,600 + (4/5 × Rs. 400)	8,920	
Indirect expenses Rs. 2,000 + (4/5 × Rs. 500)	2,400	
		<u>(b) 27,200</u>
Fixed cost :		
Supervisory salary	10,000	
Dep.	4,000	
Other	16,000	(c) <u>30,000</u>
Total cost of (a)+(b)+(c)		<u>1,67,000</u>
Profit		<u>25,000</u>

Probabilistic Budgets

Problem 15.7. H.W. & Co. projects that sales volume will be somewhere between 2,00,000 and 3,00,000 units during the coming year 1989. The company's product sells for Rs. 10 per unit. Variable costs are Rs. 6 per unit and fixed costs are Rs. 5,00,000 per year.

Required :

(a) Prepare budgeted income statement based on range of projected sales.

(b) Assuming that the company gives following three-level sales forecast.

Optimistic	3,00,000 units
Most likely	2,50,000 units
Pessimistic	2,00,000 units

Prepare a budgeted income statement based on three-level sales forecast.

(c) Assuming that H.W. Company assigns the following probabilities to each of its three sales forecasts :

Optimistic	10%
Most likely	75%
Pessimistic	15%

Find out the expected value of number of units to be sold and prepare a budgeted income statement based on expected value of forecast sales for 1989.

Solution. (a) H.W. & Co.

Budgeted income statement based on projected sales for 1989

	<i>Upper limit</i>	<i>Lower limit</i>
Unit Sales volume	3,00,000	2,00,000
Sales (Rs. 10 per unit)	Rs. 30,00,000	Rs. 20,00,000
Less : Variable Cost (Rs. 6 per unit)	18,00,000	12,00,000
Contribution	12,00,000	8,00,000
Less : Fixed Cost	5,00,000	5,00,000
Profit	7,00,000	3,00,000

(b) Budgeted income statement based on three-level forecast for 1989

	<i>Optimistic</i>	<i>Most likely</i>	<i>Pessimistic</i>
Unit Sales volume	3,00,000	2,50,000	2,00,000

Sales (Rs. 10 per unit)	Rs. 30,00,000	Rs. 25,00,000	Rs. 20,00,000
Less : Variable Cost (Rs. 6 per unit)	18,00,000	15,00,000	12,00,000
Contribution	12,00,000	10,00,000	8,00,000
Less : Fixed Cost	5,00,000	5,00,000	5,00,000
Profit	7,00,000	5,00,000	3,00,000
	=====	=====	=====

(c) (i) Calculation of expected value of number of units, which will be sold

Sales (units)	Probability	Expected value
3,00,000	10%	30,000
2,50,000	75%	1,87,500
2,00,000	15%	30,000

Expected value of number of units to be sold		2,47,500 units

(ii) Budgeted income statement based on expected value of forecast sales for 1989

Sales (2,47,500 units × Rs. 10)	Rs. 24,75,000
Less : Variable Cost (2,47,500 × Rs. 6)	14,85,000
Contribution	9,90,000
Fixed Cost	5,00,000
Profit	4,90,000

C.V.P. analysis under uncertainty

Problem 15-8. S & V Company is preparing budget for 1989 Data relating to sales, prices and costs are as follows :

Sales Price	Rs. 20 per unit
Variable Cost	Rs. 12 per unit
Fixed Costs	Rs. 2,00,000 per year

Sales forecasts have been prepared, which disclose the following.

Quantity	Probability	Quantity	Probability
15,000	10%	35,000	30%
20,000	10%	40,000	10%
25,000	10%	45,000	10%
30,000	20%		

Required :

- (a) What is the break-even quantity ?
- (b) How many units must be sold to (i) earn a profit of Rs. 60,000
(ii) incur a loss of Rs. 50,000.
- (c) Based on the sales forecast, what is the probability that the firm can break even ?
- (d) What are the probabilities of achieving sales volume involved in part (b).

Solution. (a) and (b)

S & V & Co.

Break even quantity and target profit and loss quantities

<i>Break-even quantity</i>	<i>Rs. 60,000 target profit</i>	<i>Rs. 50,000 target loss</i>
$= \frac{\text{Fixed Cost}}{\text{Contribution Margin per unit}}$	$= \frac{\text{Fixed Cost} + \text{Target profit}}{\text{Contribution Margin per unit}}$	$= \frac{\text{Fixed Cost} - \text{target loss}}{\text{Contribution Margin per unit}}$
$= \frac{\text{Rs. 2,00,000}}{(\text{Rs. 20} - \text{Rs. 12})}$	$= \frac{\text{Rs. 2,00,000} + \text{Rs. 60,000}}{(\text{Rs. 20} - \text{Rs. 12})}$	$= \frac{\text{Rs. 2,00,000} - \text{Rs. 50,000}}{(\text{Rs. 20} - \text{Rs. 12})}$
$= 25,000 \text{ units}$	$= 32,500 \text{ units}$	$= 18,750 \text{ units}$

(c) There is an 80% probability of at least break even. In other words, the cumulative probability of sales volumes equal to or greater than the 25,000 units break-even volume is 80% (10% + 20% + 30% + 10% + 10%).

(d) (i) There is a 50% probability of earning the target profit of Rs. 60,000 or more because the cumulative probability of sales being greater than 32,500 units is 50% (30% + 10% + 10%).

(ii) There is a 10% chance of incurring a loss greater than Rs. 50,000 equal to the cumulative probability that sale will be less than 18,750 units). It should also be noted that chances of incurring loss are 20% (equal to the cumulative probability of sales being less than 25,000 units).

Probability distribution and expected value

Problem 15.9. A manager is considering whether to make product A or product B, but only one can be produced. The estimated sales demand for each product is uncertain and hence the estimated profits are also uncertain. A detailed investigation of the possible sales demand for each product gives the following probability distribution of profits for each product.

Product A Probability distribution

(1) Outcome	(2) Estimated Probability
Profit of Rs. 6,000	0.10
Profit of Rs. 7,000	0.20
Profit of Rs. 8,000	0.40
Profit of Rs. 9,000	0.20
Profit of Rs. 10,000	0.10
	<hr/> 1.00 <hr/>

Production B Probability distribution

(1) Outcome	(2) Estimated Probability
Profit of Rs. 4,000	0.05
Profit of Rs. 6,000	0.10
Profit of Rs. 8,000	0.40
Profit of Rs. 10,000	0.25
Profit of Rs. 12,000	0.20
	<hr/> 1.00 <hr/>

(a) Which product should the Company make based on expected values. Add your comments to the solution.

(b) Another alternative course of action, say product C is added to the available alternative, i.e., product A and products B with following data :

Product C Probability Distribution

Outcome	Estimated Probability
Loss of Rs. 4,000	0.5
Profit of Rs. 22,000	0.5

What will be your comments if management is also interested in the degree of uncertainty of expected future profit ?

Solution : (a) Product A Probability Distribution

(1) Outcome	(2) Estimated probability	(3) Weighted amount (col. 1 × col 2)
Profit of Rs. 6,000	0.10	Rs. 600
Profit of Rs. 7,000	0.20	1,400
Profit of Rs. 8,000	0.40	3,200
Profit of Rs. 9,000	0.20	1,800
Profit of Rs. 10,000	0.10	1,000
	<hr/> 1.00 <hr/>	
Expected Value		Rs. 8,000

Product B Probability distribution

(1) Outcome	(2) Estimated Probability	(3) Weighted (col 1 × col 2) amount
Profit of Rs. 4,000	0.05	Rs. 200
Profit of Rs. 6,000	0.10	600

Profit of Rs. 8,000	0.40	3,200
Profit of Rs. 10,000	0.25	2,500
Profit of Rs. 12,000	0.20	2,400
	<u>1.00</u>	<u>8,100</u>

Expected value

Rs. 8,100

The weighted calculation indicate that product *B* is expected to produce the higher average profits in the future. However, the expected values are the averages of the possible outcomes based on management estimates. There is no guarantee that actual outcome will equal the expected value. Indeed the expected value of product *B* does not appear in the probability distribution

(b) Product C Probability Distribution

<i>Outcome</i>	<i>Estimated probability</i>	<i>Weighted Amount</i>
Loss of Rs. 4,000	0.5	(Rs. 2,000)
Profit of Rs. 22,000	0.5	Rs. 11,000
Expected value		<u>9,000</u>

Comment. Product *C* has a higher expected value than either product *A* or product *B* but it is unlikely that management will prefer product *C* to product *B*, because of the greater variability of the possible outcome. In other words, there is a greater degree of uncertainty attached to product *C*.

Normal Probability distribution

Problem 15.10. The selling price of a product for the next accounting period is Rs. 100 and the variable cost is estimated to be Rs. 60 per unit. The budgeted fixed costs for the period are Rs. 36,000. Estimated sales for the period are 1,000 units and it is assumed that the probability distribution for the estimated sales quantity is normal with a standard deviation of 90 units. The selling price, variable cost and total fixed cost are assumed to be certain.

Required :—

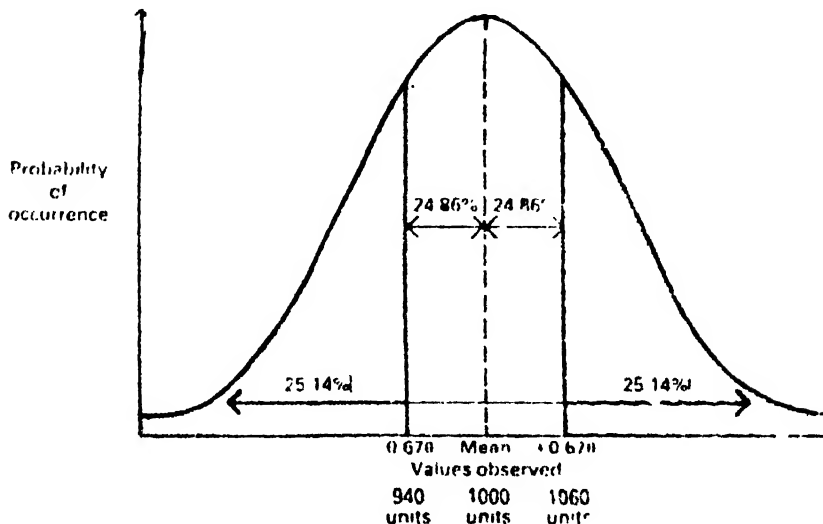
(i) Show the normal distribution for the given sales quantity. What are your comments for probability distribution for profits ?

Using the normal distribution theory, answer the following questions :

- (ii) (a) What is the probability of a loss occurring or of profits being greater than zero ?
- (b) What is the probability of profits being greater than Rs. 7,600 ?
- (c) What is the probability of a loss in excess of Rs. 1,400 ?
- (d) Show how this information should be presented along with comments.

Solution :

(i) Normal distribution for the given sales quantity.



The normal probability distribution for the sales quantity is shown above. The probability that actual sales quantity will be greater than 1,060 units is shown by the shaded area to the right of 1,060 units. Alternatively the probability that actual sales will be less than 940 units is shown by the shaded area to the left of 940 units. Because the probability distribution for sales quantity is normal with a mean of 1,000 units and a standard deviation of 90 units, and the selling price, the variable costs and the fixed costs are assumed to be certain, the probability distribution for profits will also be normal with a mean of Rs. 4,000 and standard deviation of Rs. 3,600. The calculations are as follows :

Expected profit = Expected sales volume (1,000 units) × Contribution per unit of Rs. 40 — Fixed costs (Rs. 36,000)

Standard deviation = Standard deviation of sales volume (90 units) × contribution per unit of Rs. 40

(ii) These questions can be answered by calculating how many standard deviations each of the possible observations are from the mean. We know that :

Number of standard deviations from the mean

$$= \frac{X - \text{Mean}}{\text{Standard deviation}}$$

where X equals the relevant outcome.

(a) For a profit level of nil the calculation is :

Number of standard deviations from the mean

$$= \frac{0 - 4000}{3600} = -1.11$$

This calculation indicates that a profit of zero lies -1.11 standard deviations from the mean. To determine the probability that profit will be zero or less, we consult the normal probability distribution table. We find from the table that there is a 0.1335 probability that an observation will be less than -1.11 standard deviations from the mean of the distribution. It is indicated that 13.35% of the observations will fall to the left of -1.11 standard deviations. Therefore, the probability of a loss occurring is 13.35% (or 0.1335). The unshaded area indicates that the probability of an observation to the right of -1.11 standard deviations from the mean is 86.65% (or 0.8665). The total area under the normal curve is 1.0.

(b) The probability of profits being greater than Rs. 7,600.

The probability that profits will be in excess of Rs. 7,600 will result in an observation of one standard deviation from the mean. This is calculated as follows :

$$= \frac{7,600 - 4,000}{3,600} = +1.0 \text{ standard deviation}$$

It is seen from the normal probability table 3 that the probability of an observation of $+1.0$ standard deviation from the mean is 0.1587. The probability of profits being greater than Rs. 7,600 is therefore 15.87%.

(c) The probability of a loss in excess of Rs. 1,400.

Finally, the probability of a loss in excess of Rs. 1,400 results in an observation of -1.5 standard deviations from the mean, calculated as follows :

$$= \frac{-1400 - (4000)}{3600} = -1.5 \text{ standard deviations}$$

Consequently, the probability of a loss in excess of Rs. 1,400 is 0.0668.

The manager knows that the estimated break-even sales are 900 units (Rs. 36,000 fixed costs divided by a contribution of Rs. 40 per unit) and that the expected sales are 1,000 units giving a profit of Rs. 4,000. In addition, normal distribution theory enables the following information to be presented :

- (1) The probability of a loss occurring is 0.1335 and the probability of a profit occurring is 0.8665.
- (2) The probability of profits being at least Rs. 7,600 is 0.1587.
- (3) The probability of a loss in excess of Rs. 1,400 is 0.0668.

If the manager is comparing this product with other products then this approach will enable him to assess the risk involved for each product.

as well as to compare the relative break-even points and expected profits. The analysis can be modified to include fixed cost, variable cost and selling price as uncertain variables. The effect of treating these variables as uncertain will lead to an increase in the standard deviation because the variability of the variable cost, fixed cost and selling price will add to the variability of profits.

Decision Tree

Problem 15.11. A company is considering whether to develop and market a new product. Development costs are estimated to be Rs. 1,80,000. and there is a 0.75 probability that the development effort will be successful and a 0.25 probability that the development effort will be unsuccessful. If the development is successful, the product will be marketed, and it is estimated that :

- (1) if the product is very successful profits will be Rs. 5,40,000 ;
- (2) if the product is moderately successful profits will be Rs. 1,00,000
- (3) if the product is a failure, there will be a loss of Rs. 4,00,000.

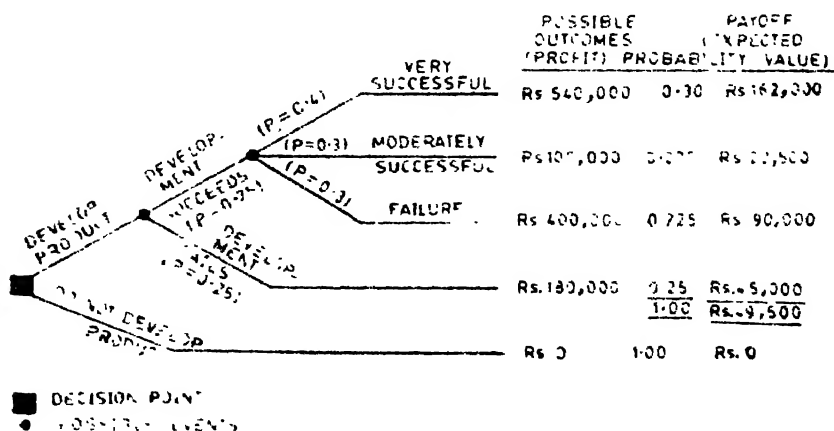
Each of the above profit and loss calculations is after taking into account the development costs of Rs. 1,80,000. The estimated probabilities of each of the above events are as follows :

- | | |
|---------------------------|-----|
| (1) Very successful | 0.4 |
| (2) Moderately successful | 0.3 |
| (3) Failure | 0.3 |

Required (i) Prepare decision tree

(ii) Offer your comments.

Solution :



(ii) The decision tree is set out above. The box indicates the point at which decisions have to be taken and the branches emanating from it indicate the available alternative courses of action. The circles indicate the points at which there are environmental changes which affect the consequences of prior decisions. The branches from these points indicate the possible types of environment (states of nature) which may occur.

The joint probability of two events occurring together is the probability of one event times the probability of the other event. For example the probability of the development effort succeeding and the product being very successful consists of the products of the probabilities of these two events : that is 0·75 times 0·4 giving a probability of 0·30. Similarly, the probability of the development effort being successful and the product being moderately successful is 0·225 ($0·75 \times 0·3$). The total expected value for the decision to develop the product consists of the sum of all the items in the expected value column on the 'Develop product' branch of the decision tree, that is Rs. 49,500. If it is assumed that there are no other alternatives available, other than the decision not to develop, the expected value of Rs. 49,500 for developing the product can be compared with the expected value of zero for not developing the product. Decision theory would suggest that the product should be developed because a positive expected value occurs. However, this does not mean that an outcome of Rs. 49,500 profit is guaranteed. The expected value calculation indicates that if the probabilities are correct and this decision was repeated on many occasions an average profit of Rs. 46,500 would result.

Expected value (Joint Probability)

Problem 15·12. For the past 20 years a charity organisation has held an annual dinner and dance with the primary intention of raising funds.

This year there is concern that an economic recession may adversely affect both the number of persons attending the function and the advertising space that will be sold in the souvenir published for the occasion.

Based on past experience and current prices and quotations, it is expected that the following costs and revenues will apply for the function :

Costs :	Dinner and Dance	Hire of Premises	Rs. 700
		Band and entertainers	2,800
		Raffle prizes	800
		Photographer	200
		Food at Rs. 12 per person (with a guarantee of 400 persons minimum)	
	Souvenir :	A fixed cost of Rs. 2,000, plus Rs. 5 per page	
Revenues	Dinner and Dance :	Price of tickets	Rs. 2 ⁿ per person
		Average revenue from :	

Raffle	Rs. 5 per person
Photographs	Rs. 1 per person
Souvenir	Average revenue from advertising Rs. 70 per page

A sub-committee, formed to examine more closely the likely outcome of the function, discovered the following from previous records and accounts :

No. of tickets sold	No. of past occasions	No. of souvenir pages sold	No. of past occasions
250 to 349	4	24	4
350 to 449	6	32	8
450 to 549	8	40	6
550 to 649	2	48	2
	20		20

Several members of the sub-committee are in favour of using a market research consultant to carry out a quick enquiry into the likely number of tickets and the likely number of pages of advertising space that would be sold for this year's dinner and dance.

You are required to :

(a) calculate the expected value of the profit to be earned from the dinner and dance this year ;

(b) recommend, with relevant supporting financial and cost data, whether or not the charity should spend Rs. 500 on the market research enquiry and indicate the possible benefits the enquiry could provide,

NB : All workings for tickets should be in steps of 100 tickets and for advertising in steps of 8 pages. [I.C.M.A. (London), Nov. 1981]

Solution. (a) Statement showing expected values from

Dinner and Dance

No. of tickets sold	Frequency	Probability (a)	Revenues (excluding souvenir)	Cost Food	Fixed	Total (Loss) (a) × (b)	Expected values
			Rs.	Rs.	Rs.		
300	4	0.2	7,800	4,800*	4,500	9,300 (1,500)	(300)
400	6	0.3	10,400	4,800	4,500	9,300 1,100	330
500	8	0.4	13,000	6,000	4,500	10,500 2,500	1,000
600	2	0.1	15,600	7,200	4,500	11,700 3,900	390
	20	1.0					Rs. 1,420

*Food cost @ Rs 12 per person (Minimum guarantee of 400 persons)

Annual Expected profit from Dinner = Rs. 1,420 ... (i)

<i>No. of pages sold</i>	<i>Frequ- ency</i>	<i>Proba- bility (a)</i>	<i>Revenues @ Rs. 70 per page</i>	<i>Costs</i>	<i>Profit (Loss) (b)</i>	<i>Expected value (a) × (b)</i>
24	4	0·2	Rs. 1,680	Rs. 2,120	(440)	Rs. (88)
32	8	0·4	2,240	2,160	80	32
40	6	0·3	2,800	2,200	600	180
48	1	0·1	3,360	2,240	1,120	112
	—	—				—
	20	1·0				236

Total expected profit = Rs. 1,656 ... (i) + (ii)

(iv) The souvenir sales (and associated probabilities) are independent of the number of tickets sold.

Loss when 300 tickets are sold ($P = 0.02$)		Profit/(Loss) on souvenir sales with probabilities		(a) Total Loss	(b) Joint Probability	(a) × (b) Expected Loss
Rs.	P_1		P_2		$P_1 \times P_2$ P_2	(Rs.)
(1,500)	0.2	(Rs. 440)	0.2	(1,940)	0.04	(77.60)
(1,500)	0.2	80	0.4	(1,420)	0.08	(113.60)
(1,500)	0.2	600	0.3	(900)	0.06	(54.00)
(1,500)	0.2	1,120	0.1	(380)	0.02	(7.60)
						(252.80)

The charity has to spend Rs. 500 on the market research enquiry and the total avoidable expected loss is Rs. 252'80. Therefore, it is not worthwhile to spend on market research enquiry.

Expected values (Investment decision)

Problem 15'13. TTD Ltd. is now considering the purchase of a new machine for Rs. 350. The Directors feel quite confident that they can sell the goods produced by the machine so as to yield a yearly cash surplus of Rs. 100. There is, however, some uncertainty as to the machine's working life. A recently published Trade Association survey shows that members of the association have between them owned 250 of these machines and have found the lives of the machine to vary as follows :

<i>Number of years of machine life</i>	<i>Number of machines having given life</i>
3	20
4	50
5	50
6	70
7	10
	<hr/> 250 <hr/>

Assuming a discount rate of 10%, the net present value for each different machine life is as follows :

<i>Machine life</i>	<i>Net present value</i>
3	(101)
4	(33)
5	29
6	86
7	137

As a Management Accountant, you are asked to advise whether the company should purchase a new machine or not.

[I.C.M.A. (London), May 1982]

Solution. First of all, it is necessary to work out the probability for the different years of machine life. If the life is 3 years, the probability is $20 \div 250 = 0.08$ and if life is 4 years, the probability is $50 \div 250 = 0.20$ and so on. The expected value is arrived at by multiplying in present value with probability of occurrence as under :

<i>Machine life in years</i>	<i>Net present value (Rs.)</i>	<i>No. of machines having given life</i>	<i>Probability of occurrence</i>	<i>Expected net present value (Rs.)</i>
3	(101)	20	0.08*	(8.10)@
4	(33)	50	0.20	(6.60)
5	29	100	0.40	11.60
6	86	70	0.28	24.10@
7	137	10	0.04	5.50@
		250	1.00	Rs. 26.50

TTD Ltd. should go ahead with the purchase of a new machine as it yields a positive expected net present value of Rs. 26.50.

* $20 \div 250 = 0.08$ and so on.

@ rounded off

Optimal product mix using LP

Problem 15.14. A Company manufactures two products each of which is processed in the same two production departments. The capacity in each department is measured by the number of machine hours which are limited to 9,000 hours in Department 'X' and 15,000 hours in Department 'Y' per annum.

The data relating to the two products are as under :

	<i>Product AXE</i>	<i>Product BXE</i>
Selling Price per unit	Rs. 300	Rs. 100
Variable Cost per unit	240	60
Machine Hours per unit		
Department X	4	1
Department Y	2	3

The order book analysis shows that the Company has received sales orders for 2,000 units of *AXE* and 5,000 units of *BXE*. The fixed overheads of the two departments are as under :

Department X Rs. 18,000 per annum

Department Y Rs. 60,000 per annum.

Required :

- (i) Find the profitability if the company executes the order for the supply in the following manner :
 - (a) 2,000 units of *AXE* and 1,000 units of *BXE*.
 - (b) 5,000 units of *BXE* alone.
- (ii) Indicate the cost of idle time arising out of the execution of the aforesaid two orders separately.
- (iii) Set an optimal product mix and evaluate its profitability.

(I.C.W.A. Final, June 1988)

Solution. (i) Statement showing contribution per unit :

	Product <i>AXE</i>	Product <i>BXE</i>
Selling Price per unit	Rs. 300	Rs. 100
Variable Cost per unit	240	60
Contribution per unit	60	40

(a) For 2,000 units of <i>AXE</i> , contribution will be	
2,000 × Rs. 60	Rs. 1,20,000
For 1,000 units of <i>BXE</i> , contribution will be	
1,000 × Rs. 40	40,000

Total contribution	1,60,000
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Less : Fixed Cost :

Department X—Rs. 18,000	
Department Y—Rs. 60,000	
	78,000

Profit	82,000
--------	--------

(b) For 5,000 units of <i>BXE</i> , Contribution	
(5,000 × Rs. 40)	Rs. 2,00,000
Less Fixed cost (as above)	78,000

Profit	1,22,000
--------	----------

(b) Statement showing the idle hours

Situation 1 (a)

	Output	Deptt. X	Deptt. Y
<i>AXE</i>	2,000 units	8,000 hrs	4,000 hrs.
<i>BXE</i>	1,000 units	1,000 hrs	3 000 hrs.
Hours utilized		9,000 hrs	7,000 hrs.
Hours available		9,000 hrs	15,000 hrs.
Idle Hours		—	8,000 hrs.

Situation 1 (b)

	Output	Deptt. X	Deptt. Y
<i>BXE</i>	5,000 units	5,000 hrs	15,000 hrs.
Hours available		9,000 hrs	15,000 hrs.
Idle Hours		4,000	—

Fixed overhead recovery rate

	Deptt. X	Deptt. Y
Hours Available	9,000	15,000
Fixed Overhead	Rs. 18,000	Rs. 60,000

Fixed OH Recovery Rate Rs. 2 per hr.

Rs. 4 per hr.

Cost of idle hours in Deptt. X in situation 1 (b)

$$= 4,000 \text{ hrs} \times \text{Rs. } 2$$

Rs. 8,000

Cost of idle hours in Deptt. Y in situation 1 (a)

$$= 8,000 \text{ hrs} \times \text{Rs. } 4$$

Rs. 32,000

(iii) Contribution per unit of *AXE* and *BXE* are respectively Rs 60 and Rs. 40. For optimal product mix, we take x_1 and x_2 as production units of *AXE* and *BXE* respectively.

Thus we have to maximise $Z = 60x_1 + 40x_2$ Subject to $4x_1 + x_2 \leq 9,000$

$$2x_1 + 3x_2 \leq 15,000$$

$$x_1, x_2 \geq 0.$$

Introduces slack variables s_1 and s_2 and convert inequations to equations.

$$4x_1 + x_2 + s_1 = 9,000, \quad 2x_1 + 3x_2 + s_2 = 15,000$$

Simplex Table

			60	40	0	0
			x_1	x_2	s_1	s_2
0	s_1	9,000	4	1	1	0
0	s_2	15,000	2	3	0	1
			↑			
60	x_1	2,250	1	1/4	1/4	0
0	s_2	10,500	0	5/2	-1/2	1
			60	15	15	0
	ΔJ		0	-25 ↑	15	0
60	x_1	1,200	1	0	3/10	-1/10
40	x_2	4,200	0	1	-1/5	2/5
			60	40	10	10
	ΔJ		0	0	10	10

∴ Optimum production is $x_1 = 1,200$ and $x_2 = 4,200$ which are within the sales limits of $x_1 \leq 2,000$, $x_2 \leq 5,000$.

Evaluation of alternative plans by using Probability

Problem 15.15. Dry Twigs and Fresh Blossoms Ltd. is always discarding old lines and introducing new lines of products and is at present considering three alternative promotional plans for ushering in new products. Various combinations of prices, development expenditures and promotional outlays are involved in these plans. High, medium and low forecasts of revenues under each plan have been formulated; and their respective probabilities of occurrence have been estimated. These budgeted revenues and probabilities along with other relevant data are summarised as under :

	Rs. in lakhs		
	Plan I	Plan II	Plan III
Budgeted Revenue with probability			
High	30 (.3)	24 (.2)	50 (.2)
Medium	20 (.3)	20 (.7)	25 (.5)
Low	5 (.4)	15 (.1)	0 (.3)
Variable Cost as % of Revenue	60%	75%	70%
Initial Investment	25	20	24
Life in years	8	8	8

The Company's Cost of Capital is 12% ; the income tax rate is 40%. Investments in promotional programmes will be amortised by the straight line method. The Company will have net taxable income in each year, regardless of the success or failure of the new products. The present value of an annuity of Re. 1/- at 12% for 8 years is 4.9676.

(a) Substantiating with figures make a detailed analysis and find out which of the promotional plans is expected to be the most profitable.

(b) In the event the worst happened, which of the plans would result in the maximising profit.

(I.C.W.A. Final, June 1988)

Solution. (a) It is given in the question that variable costs as percentage of revenue of three plans are 60%, 75% and 70% respectively. Alternatively, the contribution ratio of three plans will be 40%, 25% and 30% respectively. As the fixed cost is not given in this case, profitabilities of the three plans (including equated values) are indicated below :

Budgeted revenue multiplied by Probability	Plan I	Plan II	Plan III
High	Rs. 9,00,000	Rs. 4,80,000	Rs. 10,00,000
Medium	6,00,000	14,00,000	12,50,000
Low	2,00,000	1,50,000	—
Expected Values	17,00,000	20,30,000	22,50,000
Profit contribution (%)	40%	25%	30%
Profit before tax	6,80,000	5,07,500	6,75,000
Profit after tax 40%	4,08,000	3,04,500	4,05,000
* Tax saving from amortization	1,25,000	1,00,000	1,20,000

* (Initial investment ÷ 8) × 40%.

Amount received after tax	5,33,000	4,04,500	5,25,000
(i) Present Value (Amount received multiplied by 4.9676)	26,47,731	20,09,394	26,07,990
(ii) Initial Investment	25,00,000	20,00,000	24,00,000
(iii) NPV (i) — (ii)	1,47,731	9,394	2,07,990
(iv) Profitability Index (i) ÷ (ii)	1.059	1.005	1.087

Profitability index is higher in respect of Plan III.

(b) **Minimum Loss from the Plan in the event of worse happening**

	Plan I	Plan II	Plan III
Revenue in case of low forecast	Rs. 5,00,000	Rs. 15,00,000	Rs. 0
Profit (%)	40%	25%	30
Profit before tax	2,00,000	3,75,000	0
Tax @ 40%	80,000	1,50,000	0
Profit after tax	1,20,000	2,25,000	0
Tax saving from amortisation	1,25,000	1,00,000	1,20,000
Lowest receipt after tax	2,45,000	3,25,000	1,20,000
PV of cash receipt after applying factor of 4.9676	12,17,062	16,14,470	5,96,000
Initial outlay	25,00,000	20,00,000	24,00,000
Net Present Value	(12,82,938)	(3,85,530)	(18,04,000)

Plan II should be adopted as it resulted in the lowest NPV.

Learning Curve

Problem 15 16. (a) Your Company has been approached by a customer to supply four units of a new product made to the customer's individual specification. The company experiences a 90% learning rate. The estimated labour time for the first unit of this product is 150 hours and the company's direct labour cost is Rs. 5 per hour. Estimate the labour cost for this order.

(b) After receiving the first order, if the customer places a repeat order, what will be the labour cost for the second order.

(c) If the customer had ordered all eight units at the same time, calculate the labour cost per unit for the combined order.

(I.C.W.A. Final, 1988)

Solution. (a)

Units Produced	Cum. Production	Avg. time per unit (Hrs.)	Total labour time (4)
(1)	(2)	(3)	(2) × (3)
1	1	150.0	150.0
1	2	135.0 (90% of 150)	270.0
2	4	121.5 (90% of 135)	486.0

Estimated labour cost for the order = $486 \times \text{Rs. } 5 = \text{Rs. } 2,430$

Labour cost per unit = $\text{Rs. } 607.50$

(b) The first order relates to four units.

The repeat order will be for another four units

Thus, average labour hours for 8 units will be

Average time per unit = 90% of 121.5 = 109.35 hrs.

Average time for 8 units = $109.35 \times 8 = 874.80$

Less : time spent on first order 486.0

Time spent on this order 388.8

Total labour cost for second order

= $388.8 \times \text{Rs. } 5 = 1944$ or 486 per unit

(c) Labour Cost of combined order

Units produced	Cum. Production	Avg. time per unit	Total labour time
(1)	(2)	(3)	(2) × (3)
1	1	150.0	150
1	2	135.0	270
2	4	121.5	486
4	8	109.35	874.8

Estimated labour cost for combined order

= $874.8 \times \text{Rs. } 5 = \text{Rs. } 4,374$

Estimated labour cost for 1 unit

= $\text{Rs. } 546.75$

Probability (Expected Value of perfect information)

Problem 15.17. (a) A Ltd. has a choice between three projects X, Y and Z. The following information has been estimated :

Projects	Market demand (profits) Rs. '000		
	D_1	D_2	D_3
X	190	50	15
Y	110	200	160
Z	150	140	110

Probabilities are $D_1 = 0.6$, $D_2 = 0.2$, $D_3 = 0.2$

Which project should be undertaken if decision is made by expected value approach ?

(b) Calculate the expected value of perfect information ?

(I.C.W.A. Final, June 1988)

Solution. (a) Expected Values of three Projects

Project	Demand	Profit (Rs. '000)	Probability	Rs. '000
X	D_1	190	0.6	114
	D_2	50	0.2	10
	D_3	15	0.2	3
				<hr/> EV 127 <hr/>
Y	D_1	110	0.6	66
	D_2	200	0.2	40
	D_3	160	0.2	32
				<hr/> EV 138 <hr/>
Z	D_1	150	0.6	90
	D_2	140	0.2	28
	D_3	110	0.2	22
				<hr/> EV 140 <hr/>

Project Z should be preferred as it yields highest expected value of Rs. 1,40,000.

(b) The maximum value of perfect information will be equal to EV with information *minus* EV without information :

Demand	Preference	Profit (Rs. '000)	Probability	EV (Rs. '000)
D_1	X	190	0.6	114
D_2	Y	200	0.2	40
D_3	Y	160	0.2	32
EV with perfect information				<hr/> 186 <hr/>

Therefore, EV of perfect information

$$= \text{Rs. } 1,86,000 - 1,40,000 = \text{Rs. } 46,000.$$

Probability (Sensitivity Analysis)

Problem 15'18 (a) Your Company has estimated the unit variable cost of a product to be Rs. 10 and the selling price is Rs. 15 per unit. Budgeted sales for the year are 20,000 units.

Estimated fixed costs are as follows :

Fixed Costs per annum	Probability
Rs. 50,000	0.1
60,000	0.3
70,000	0.3
80,000	0.2
90,000	0.1

What is the probability that the company will equal or exceed its target profit of Rs. 25,000 for the year ?

(b) X Ltd. is considering a project with the following cash flows :

Year	Purchase of Plant	Running Costs	Saving
0	Rs. (7,000)		
1		Rs. 2,000	Rs. 6,000
2		2,500	7,000

The cost of capital is 8%. Measure the sensitivity of the project to changes in the levels of Plant Value, Running Costs and Savings (considering each factor at a time) such that Net Present value becomes zero. Which factor is most sensitive to affect the acceptability of the project. The present value factors at 8% are as follows :

Year	Factor
0	1.00
1	0.93
2	0.86

(I.C.W.A. Final, June 1988)

- (a) Budgeted sales for the year = 20,000 units
 Budgeted contribution per unit = Rs. 15 - Rs. 10 = Rs. 5
 Budgeted total contribution = 20,000 × Rs. 5 = Rs. 1,00,000
 Target profit = 25,000
 Maximum fixed cost to meet the target = 75,000

The probability of fixed cost of Rs. 75,000 will be
 $= 0.1 + 0.3 + 0.3 = 0.7$

(b) Present values of cash flows :

Year	Discount factor at 8%	PV of Plant cost (Rs. 7,000)	PV of Running cost	PV of Savings	NPV
0	1.00	(Rs. 7,000)	—	—	(Rs. 7,000)
1	0.93		(Rs. 1,860)	Rs. 5,580	3,720
2	0.86		(2,150)	6,020	3,870
		(Rs. 7,000)	4,010	11,600	NPV 590
					=====

The project has positive NPV and therefore may be accepted. The changes in cash flows which would need to occur before the project just breaks-even: (NPV = 0)

Sensitivity Analysis (Variation of PV of Rs. 590)

- (1) The plant cost would need to increase by
 viz. $(Rs. 590 \div 7,000) \times 100 = 8.4\%$
- (2) The running cost would need to increase by
 $(590 \div 4,010) \times 100 = 14.7\%$

- (3) Savings will fall short by :
 $(590 \div 11,600) \times 100 = 5.1\%$

Saving is therefore more sensitive to affect the acceptability of the project.

Replacement of existing machine by use of t-distribution test

Problem 15.19. You are currently investigating the replacement of electric type writers with electronic machine. One argument put forward for such replacement is that of improved speed as measured in words per minute. Eight typists from the company typing pool are involved in an experiment where they undertake work of a comparable nature on both type of machines. The results are shown in the table below :

Typist	Electric Machine w p m.	Electronic Machine w p m.
1	72	76
2	69	67
3	56	61
4	63	63
5	59	64
6	68	74
7	59	65
8	62	70

You are required to decide whether the evidence from the experiment supports the argument put forward for introducing electronic typewriters by applying *t* distribution test

(C.I.M.A. London, November 1988)

Solution :

Test Workings

Typist	Electric	Electronic	Difference
1	72	76	4
2	69	67	2
3	56	61	-5
4	63	63	0
5	59	64	-5
6	68	74	-6
7	59	65	-6
8	62	70	-8

		Total	-32

$$\bar{d} = \frac{\sum d}{n} = \frac{-32}{8} = -4 \text{ words per minute}$$

$$S_d = \sqrt{\frac{\sum (d - \bar{d})^2}{n-1}}$$

$d - \bar{d}$	$d - \bar{d}$	$(d - \bar{d})^2$
$-4 - (-4)$	0	0
$2 - (-4)$	6	36
$-5 - (-4)$	-1	1
$0 - (-4)$	4	16
$-5 - (-4)$	-1	1
$-6 - (-4)$	-2	4
$-6 - (-4)$	-2	4
$-8 - (-4)$	-4	16
	0	78

$$S_d = \sqrt{\frac{78}{7}} = \sqrt{11.142857} = 3.3380918$$

$$t = \frac{\bar{d} - d}{S_d / \sqrt{n}} = \frac{-4 - 0}{3.3380918 / \sqrt{8}}$$

$$= \frac{-4}{3.3380918 / 2.8284271} = \frac{-4}{1.1801937}$$

$$= -3.389242 \quad t = -3.39$$

From tables, the t score for 7 degrees of freedom is 1.895.

The evidence from the experiment is strong enough to reject the null hypothesis and to conclude that increased speed may be obtained from electronic machines.

Pricing and Purchasing Decisions using Probability

Problem 15-20. Z Ltd is considering various product pricing and material purchasing options with regard to a new product it has developed. Estimates of demand and costs are as follows:

If selling price per unit is		Rs. 1 per unit	Rs. 20 per unit
		Sales volume ('000 units)	Sales volume ('000 units)
FORECAST	PROBABILITY		
Optimistic	0.3	36	28
Most likely	0.5	28	23
Pessimistic	0.2	18	13
Variable manufacturing costs (excluding materials) per unit		Rs. 3	Rs. 3
Advertising and selling costs		Rs. 25,000	Rs. 96,000
General fixed costs		Rs. 40,000	Rs. 40,000

Each unit requires 3 kg of material and because of storage problems any unused material must be sold at Re. 1 per kg. The sole suppliers of the material offer three purchase options, which must be decided at the outset, as follows :

- (i) any quantity at Rs. 3 per kg; or
- (ii) a price of Rs. 2.75 per kg for a minimum quantity of 50,000 kg or
- (iii) a price of Rs. 2.50 per kg for a minimum quantity of 70,000 kg.

You are required, assuming that the company is risk neutral, to

- (a) prepare calculations to show what pricing and purchasing decisions the company should make, clearly indicating the recommended decisions ;
- (b) calculate the maximum price you would pay for perfect information as to whether the demand would be optimistic or most likely or pessimistic. (C.I.M.A. London, May 1988)

Solution. (a) Purchasing Option (i)

Selling price	Rs. 15			Rs. 20		
Variable manufacturing costs	3			3		
Gross contribution	12			17		
Advertising and selling costs (Rs. '000)	25			96		
General fixed costs (Rs. '000)	40			40		
Total fixed costs (Rs. '000)	65			136		
Sales (000)	36	28	18	28	23	13
	Rs. '000	'000	'000	'000	'000	'000
Gross contribution	432	336	216	476	391	221
Materials @						
Rs. 3 per kg \times 3 kg = Rs. 9 per unit	324	252	162	252	207	117
Material sale						
Total fixed costs	65	65	65	136	136	136
Conditional profit/(loss)	43	19	(11)	88	48	(32)
Probability	0.3	0.5	0.2	0.3	0.5	0.2
Expected profit/(loss)	12.9	9.5	(2.2)	26.4	24.0	(6.4)
			20.2			44.0

Purchasing Options (ii)

Sales (000's) × 3 kg	36	28	18	28	23	13
Material usage ('000 kg)	108	84	54	84	69	39
Minimum purchase : 50,000 kg	—	—	—	—	—	—
Actual purchase	108	84	54	84	69	50
Returns	—	—	—	—	—	—
Purchase × Rs. 2.75 = Rs. '000	297	231	148.5	231	189.75	137.5
Less : Returns @ Rs. 1	—	—	—	—	—	(11.0)
Material cost (Rs. '000)	297	231	148.5	231	189.75	126.5
	Rs. '000	'000	'000	'000	'000	'000
Gross contribution	432	336	216	476	391	221
Less : Material cost	297	231	148.5	231	189.75	126.5
Total fixed costs	65	65	65	136	136	136
Conditional profit/(loss)	70	40	2.5	109	65.25	(41.5)
Probability	0.3	0.5	0.2	0.3	0.5	0.2
Expected profit/(loss)	21.0	20.0	0.5	32.7	32.625	(8.3)
			41.5			57.025

Purchasing Option (iii)

Sales (000's) × 3 kg	36	28	18	28	33	13
Material usage (000 kg)	108	84	54	84	69	39
Minimum purchase	—	—	70	—	70	70
Actual purchase	108	84	—	84	—	—
Returns	—	—	16	—	1	31
Purchase × Rs. 2.50 = purchases (Rs. 000)	270	210	175	210	175	175
Returns @ Re. 1	—	—	(16)	—	(1)	(31)
Material cost (Rs. '000)	270	210	159	210	174	144
	Rs. '000	'000	'000	'000	'000	'000
Gross contributions	432	336	216	476	391	221
Less : Material cost	270	210	159	210	174	144
Total fixed costs	65	65	65	136	136	36
Conditional profit/(loss)	97	61	(8)	130	81	(59)
Probability	0.3	0.5	0.2	0.3	0.5	0.2
Expected profit/(loss)	29.1	30.5	(1.6)	39.0	40.5	(11.8)
			58.0			67.7

The following combination offers the highest expected profit :

Selling price of Rs. 20 and purchase option (iii), Rs. 2.50 per kg for a minimum quantity of 70,000 kg.

(b) Purchasing option	Conditional profit (Rs. '000)		
	Optimistic	Most likely	Pessimistic
(i)	43/88	19/48	(11)/(32)
(ii)	70/109	40/65.25	2.5/(41.5)
(iii)	97/130	61/81	(8)/(59)
Select best result :			
Conditional profit	130	81	2.5
Probability	0.3	0.5	0.2
Expected profit	39.0	40.5	0.5
			Rs. '000
Total expected profit with perfect information :	39.0 + 40.5 + 0.5 = 80.0		
Expected profit as per (a) above	= 67.7		
Maximum price for perfect information	= 12.3		

Coefficient of multiple correlation/determination

Problem 15.21. A management accountant is analysing data relating to retail sales on behalf of marketing colleagues. The marketing staff believes that the most important influence upon sales is local advertising undertaken by the retail store. The company also advertises by using regional television areas. The company owns more than 100 retail outlets, and the data below relate to a sample of 10 representative outlets.

Outlet number	Monthly sales Rs. '000 y	Local advertising by the retail store Rs. '000 per month x_1	Regional advertising by the company Rs. '000 per month x_2
1	220	6	4
2	230	8	6
3	240	12	10
4	340	12	16
5	420	2	18
6	460	8	20
7	520	16	26
8	600	15	30
9	720	14	36
10	800	20	46

The data have been partly analysed and the intermediate results are available below.

$\Sigma y = 4,550$	$\Sigma y^2 = 24,51,300$	$\Sigma x_1 y = 58,040$
$\Sigma x_1 = 113$	$\Sigma x_1^2 = 1,533$	$\Sigma x_2 y = 1,21,100$
$\Sigma x_2 = 212$	$\Sigma x_2^2 = 6,120$	$\Sigma x_1 x_2 = 2,780$

(a) You are required to examine closely, using co-efficients of determination, the assertion that the level of sales varies more with movements in the level of local advertising than with changes in the level of regional company advertising.

(b) Further analysis of the raw data reveals a co-efficient of multiple correlation of 0.99 and hence a co-efficient of multiple determination of 0.98. Using the least squares multiple regression equation, a sales forecast for an outlet in the same area as outlet 8 in the original data has been prepared for a planned level of Rs. 12,000 of local advertising. This produces a sales forecast of Rs. 5,97,333 for the next month.

You are required to interpret the above information for the marketing manager. (C.I.M.A. London, May 1988)

Note that the co-efficient of determination for y and x_1 may be calculated from

$$r^2 = \frac{n\sum x_1 y - \sum x_1 \sum y}{[n\sum x_1^2 - (\sum x_1)^2] \times [n\sum y^2 - (\sum y)^2]}$$

Solution. (a) Co-efficient of determination

$$r^2 = \frac{(n\sum x_1 y - \sum x_1 \sum y)^2}{[n\sum x_1^2 - (\sum x_1)^2] [n\sum y^2 - (\sum y)^2]}$$

Apply to x_1

$$\begin{aligned} r^2 &= \frac{[(10 \times 58,040) - (113 \times 4,550)]^2}{(10 \times 1,533 - 12,769)(10 \times 2,451,300 - 20,712,500)} \\ &= \frac{66,250^2}{2,561 \times 3,810,500} \\ &= \frac{4,389,900}{9,75,8690,500} = 0.4498 \end{aligned}$$

Apply to x_2

$$\begin{aligned} r^2 &= \frac{[10 \times 121,100 - (212 \times 4,550)]^2}{(10 \times 6,120 - 44,944)(10 \times 2,451,300 - 20,702,500)} \\ &= \frac{2,46,400^2}{16,256 \times 3,810,500} \\ &= \frac{60,71,2960,000}{61,94,3488,000} = 0.9801 \end{aligned}$$

Conclusion : Based on the validity of the proposition that there is a causal link between the level of advertising and the level of sales, it appears that the level of sales varies more with the level of regional advertising than with local advertising ; the regional r^2 of 0.9801 is far higher than the local r^2 of 0.4498.

$$(b) y = 158.25 - 4.81x_1 + 16.56x_2$$

$$\therefore a = 158.25 \quad b_1 = -4.81 \quad b_2 = 16.56$$

$$\begin{aligned}
 R^2 &= \frac{a\sum y + b_1\sum x_1y + b_2\sum x_2y - (\sum y)^2/n}{\sum y^2 - (\sum y)^2/n} \\
 &= \frac{(158 \cdot 25 - 4,550) + (-4 \cdot 81 \times 58,040) + (16 \cdot 56 \times 121,100) - 20,70,250}{24,51,300 - 20,70,250} \\
 &= \frac{7,20,037 \cdot 5 - 2,79,172 \cdot 4 + 2,005,416 - 2,070,250}{3,81,050} \\
 &= \frac{3,76,031 \cdot 1}{3,81,050} = 0 \cdot 9868
 \end{aligned}$$

R^2 has increased over either of the individual R^2 figures calculated in part (a), thus the use of the multiple regression model appears to improve very slightly the managers' understanding of the situation. However, it should be noted that R^2 always increases when more independent variables are added. In order to avoid including insignificant variables an adjustment coefficient of determination, R^2 , may be calculated.

Note : $Y = 158 \cdot 25 - 4 \cdot 81x_1 + 16 \cdot 56x_2$

$$\begin{aligned}
 \therefore Y &= 158 \cdot 25 - (4 \cdot 81 \times 12) + (16 \cdot 56 \times 30) \\
 &= 158 \cdot 25 - 57 \cdot 72 + 496 \cdot 80 = 597 \cdot 33
 \end{aligned}$$

Optimisation using L.P.

Problem 15.22. A company makes two products, X and Y . Product X has a contribution of Rs. 124 per unit and product Y Rs. 80 per unit.

Both products pass through two departments for processing and the times in minutes per unit are :

	Product X	Product Y
Department 1	150	90
Department 2	100	120

Currently there is a maximum of 225 hours per week available in department 1 and 200 hours in the department 2. The company can sell all it can produce of X but EEC quotas restrict the sale of Y to a maximum of 75 units per week.

The company, which wishes to maximise contribution, currently makes and sells 30 units of X and 75 units of Y per week.

The company is considering several possibilities including:

- altering the production plan if it could be proved that there is a better plan than the current one ;
- increasing the availability of either department 1 or department 2 hours. The extra costs involved in increasing capacity are Re. 0.5 per hour for each department ;
- transferring some of their allowed sales quota for Product Y to another company. Because of commitments the company would always retain a minimum sales level of 30 units.

You are required to :

- calculate the optimum production plan using the existing capacities and state the extra contribution that would be achieved compared with the existing plan ;
- advise management whether they should increase the capacity of *either* department 1 or department 2 and, if so, by how many hours and what the resulting increase in contribution would be over that calculated in the improved production plan ;
- Calculate the minimum price per unit for which they could sell the rights to their quota, down to the minimum level, given the plan in (a) as a starting point. (C.I.M.A. London, May 1988)

Solution (a) Maximise $C = 124x + 80y$

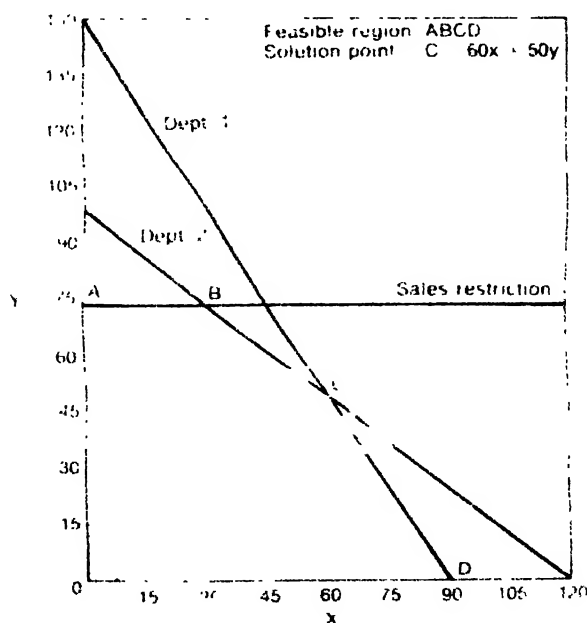
Subject to :

Dept. 1 $150x + 90y \leq 13,500$

Dept. 2 $100x + 120y \leq 12,000$

Demand $x \leq 75$
 $x, y \geq 0$

(See graph.)



From the graph :

$x = 60, y = 50$

∴ Revised contribution = $(60 \times \text{Rs. } 124) + (50 \times \text{Rs. } 80) = \text{Rs. } 11,440$

Current contribution = $(30 \times \text{Rs. } 124) + (75 \times \text{Rs. } 80) = \text{Rs. } 9,720$

∴ Increase = Rs. 1,720

- (b) Maximise production of Product X as it has the highest contribution per unit.

As per graph, maximum output of X = 120 units

	Hours required	Hours available	Additional hours
Dept. 1 $(120 \times 150 \div 60)$	300	225	75
Dept. 2 $(120 \times 100 \div 60)$	200	200	—
Contribution = $120 \times \text{Rs. } 124 =$	Rs. 14,880.0		
Less : Additional cost = $75 \times \text{Rs. } 0.5 =$	37.5		
	<u>14,842.5</u>		
Less : Contribution as per (a) above	<u>11,440.0</u>		

Advice :

Increase Dept. 1 by 75 hours ;

Increased contribution = 3,402.5

	Dept. 1	Dept. 2
(c) Total hours	225	200
Hours required for 30 units of Y $(30 \times 1\frac{1}{2})$	45	(30×2) 60
Hours available for X	180	140
Hours per unit of X	2.5	1 $\frac{1}{2}$
Production of X	72 units	84 units

Maximum production of X = 72 units

Revised contribution = $(\text{Rs. } 124 \times 72) + (\text{Rs. } 80 \times 30)$

= Rs. 8,928 + Rs. 2,400 = Rs. 11,328

Contribution per (a) 11,440

Decrease in contribution Rs. 112

Note : Y : Sales quota = 75

Production plan as per (a) = 50

Unsold quota 25

Thus, under the production plan as per (a) above, 25 units of the quota remain unsold. Since the company currently derives no benefit from this element of the quota the rights to it could be sold at the minimum price of zero.

The rights to the remaining 20 units of the quota (50—30) should be sold to negate the decrease in contribution of Rs. 112.

∴ Minimum price = Rs. 112 ÷ 20 = Rs. 5.60 per unit.

Alternative Contribution Approach—Probability Application

Problem 15-23. Y Ltd. is reviewing the price that it charges for a major product line. Over the past three years the product has had sales averaging 48000 units per year at a standard selling price of Rs. 5.25. Costs have been rising steadily over the past year and the Company is considering raising this price to Rs. 5.75 or Rs. 6.25. The sales manager has produced the following schedule to assist with the decision.

Price	Rs. 5.75	Rs. 6.25
Estimates of demand		
Pessimistic estimate (Probability 0.25)	35,000	10,000
Most likely estimate (Probability 0.60)	40,000	20,000
Optimistic estimate (Probability 0.15)	50,000	40,000
Currently the unit cost is estimated at Rs. 5.00 as follows :		
Variable Costs		
Direct Materials	Rs. 2.50	
Direct Labour Overhead	1.00	
Fixed Costs Overhead	1.00	
	0.50	
	<hr/> 5.00	

The Company considers that the most likely value for unit Variable Cost over the next year is Rs. 4.90 (probability 0.75) but it could be as high as Rs. 5.20 (probability 0.15) and it might even be as low as Rs. 4.75 (probability 0.10). Total fixed costs currently are Rs. 24,000 p.a. but it is estimated that the corresponding total for the coming year will be :

Rs. 25,000 with a probability of 0.2
 Rs. 27,000 with a probability of 0.6
 Rs. 30,000 with a probability of 0.2

(Demand quantities, unit costs and fixed costs can be assumed to be statistically independent).

Analyse the foregoing information in a way which you consider will assist management with the problem, give your views on the situation and advise on the new selling price. Calculate the expected level of profit that would follow from the selling price that you recommend.

(I.C.W.A. Final Dec., 1988)

Solution. Statement showing possible contributions when price is increased to Rs. 5.75 or Rs. 6.25

Outcome	Probability	New Price	V. Cost	Contri	New Price	V. Cost	Contri
Most likely	0.75	Rs. 5.75	4.90	0.85	6.25	4.90	1.35
High	0.15	5.75	5.20	0.55	6.25	5.20	1.05
Low	0.10	5.75	4.75	1.00	6.25	4.75	1.50

By incorporating the probability and contribution with the given estimates of demand in the following table :

When the selling price is Rs. 5.75

<i>Demand</i>	<i>Proba- bility</i>	<i>Probabi- listic demand</i> <i>1 × 2</i>	<i>Contribution per unit</i>	<i>Proba- bility</i>	<i>Probabilistic Contribution</i> <i>4 × 5</i>	<i>E.V. of Contribution</i> <i>3 × 6</i>
(1)	(2)	(3)	(4)	(5)	(6)	(7)
35,000	0.25	8,750	0.85	0.75	0.6375	Rs. 5,578
		8,750	0.55	0.15	0.0825	722
		8,750	1.00	0.10	0.1000	875
40,000	0.60	24,000	} same as above		0.6375	15,300
		24,000			0.0825	1,980
		24,000			0.1000	2,400
50,000	0.15	7,500	} same as above		0.6375	4,781
		7,500			0.0825	619
		7,500			0.1000	750
Expected Value						Rs. 33,005

When the selling price is Rs. 6.25

10,000	0.25	2,500	1.35	0.75	1.0125	2,531
		2,500	1.05	0.15	0.1575	394
		2,500	1.50	0.10	0.1500	375
20,000	0.60	12,000	} same as above		1.0125	12,150
		12,000			0.1575	1,890
		12,000			0.1500	1,800
40,000	0.15	6,000	} same as above		1.0125	6,075
		6,000			0.1575	945
		6,000			0.1500	900
Expected value						Rs. 27,060

Now the expected value of fixed cost is to be found out to arrive at the net profit.

<i>Estimated total fixed costs</i>	<i>Probability</i>	<i>E.V. of fixed Cost</i>
Rs 25,000	0.2	Rs. 5,000
27,000	0.6	16,200
30,000	0.2	6,000
E. V.		27,200

Alternative Net profit under two pricing patterns.

Details	Price pattern	
	Rs. 5.75	Rs. 6.25
Expected value of Contribution	Rs. 33,005	Rs. 27,060
Less : Expected value of Fixed costs	27,200	27,200
Expected Net Profit	5,805	(-) 140

The management should opt for a selling price of Rs. 5.75.

Maximin and Minimax Criteria for Decision Making

Problem 15.24. A manufacturer makes a product, of which the principal ingredient is a chemical *X*. At the moment, the manufacturer spends Rs. 1,000 p.a. on his supply of *X*, but there is a possibility that the price may soon increase to four times its present figure because of a world shortage of the chemical. There is another chemical *Y*, which the manufacturer could use in conjunction with a third chemical, *Z*, in order to give the same effect as chemical *X*. Chemical *Y* and *Z* would together cost the manufacturer Rs. 3,000 p.a.; but their prices are unlikely to rise.

What action should the manufacturer take ?

Apply the Maximin and Minimax Criteria for decision making and give two sets of solutions *(I.C.W.A. Final Dec., 1988)*

Solution. Two options available to the manufacturer are :

a_1 —Use chemical *Y* in conjunction with chemical *Z* with no price increase.

a_2 —Use principal chemical *X* with the possibility of price increase to four times.

Maximin

The pay-off matrix is as follows :

Applying the MAXIMIN rule :		
Action	Minimum payoff	Maximum of these
a_1	—3,000	—3,000
a_2	—4,000	—1,000

Hence action a_1 should be preferred.

Manufacturer should switch over to chemicals *Y* and *Z*.

Minimax. Minimax minimises the opportunity loss or maximum regret incurred by taking a particular action decision. Regret is the amount of pay-off lost by *not* taking the optimal action for any particular

event. Under event b_1 , the optimal action is a_1 . If the manufacturer choose action a_2 instead of a_1 , he would be Rs. 1,000 p.a. worse off. His regret at choosing a_2 rather than a_1 is thus Rs. 1,000. Since a_1 is the optimal action under b_1 , his regret in choosing a_1 is zero.

Applying the MINIMAX Rule :

Action	Maximum Regret	Minimise of these
a_1	2,000	
a_2	1,000	1,000

	b_1	b_2
a_1	0	2,000
a_2	1,000	0

Hence action a_2 should be preferred.

Probabilistic Budget

Problem 15 25. Better Budgets Ltd. are preparing their budget for 1989. In the preparation of the budget they would like to take no chances, but would like to envisage all sorts of possibilities and incorporate them in the Budget. Their considered estimates are as under :

(a) If the worst possible happens, sales will be 8,000 units at a price of Rs. 19 per unit the material cost will be Rs. 9 per unit, direct labour Rs. 2 per unit, and the variable overhead will be Rs. 1 50 per unit. The fixed cost will be Rs. 60,000 per annum.

(b) If the best possible happens, sales will be 15,000 units at a price of Rs. 20 per unit. The material cost will be Rs. 7 per unit, direct labour Rs. 3 per unit and the variable overhead will be Rs. 1 per unit. The fixed cost will be Rs. 48,000 per annum.

(c) It is most likely, however, that the sales will be 2,000 units above the worst possible level at a price of Rs. 20 per unit. The material cost will be Rs. 8 per unit, direct labour Rs. 3 per unit and the variable overhead will be Rs. 1 per unit. The fixed cost will be Rs. 50,000 per annum.

(d) There is a 20% probability that the worst will happen, a 10% probability that the best will happen and a 70% probability that the most likely outcome will occur.

What will be the expected value of Profit as per the Budget for 1989 ?
(I.C.W.A. Final Dec., 1988)

Solution Preparation of Probabilistic Budget for 1989—Better Budgets

	Pessimistic 8,000	Most Likely 10,000	Optimistic 15,000
Sales Volume (units)			
Sales Value	Rs. 1,52,000	Rs. 2,00,000	Rs. 3,00,000

<i>Less</i> : Variable cost		Rs.		Rs.	
@ Rs. 12.50	1,00,000	@ 12	1,20,000	@ 11	1,65,000
Contribution	52,000		80,000		1,35,000
<i>Less</i> : Fixed Cost	60,000		50,000		48,000
Profit/(Loss)	(8,000)		30,000		87,000
Probability	0.2		0.7		0.1
Expected value	(1,600)		21,000		8,700
Expected Value of profit as per the budget for 1989	Rs. 28,100				

Problem 15-26. (B.E. Simulated variables) New Horizons Ltd is considering the introduction of a new product and has supplied you the following information :

	<i>Expected</i>	<i>Standard Deviation</i>
Sales Quantity	5,000	400
Selling Price per unit (Rs.)	300	5
Fixed Costs (Rs.)	5,80,000	10,000
Variable Costs per unit (Rs.)	175	7.5

You are required :

(a) to calculate the expected Break-even volume and the expected profit for the period.

(b) to explain how you would carry out a simulation to arrive at an approximate distribution of profits. Illustrate your answer by using the cumulative distribution, an abstract of which has been given and using the following random number 20, 96, 68, 59 for the four variables respectively to obtain one simulated figure for profit.

For simplicity, assume that all the random variables are independent and that the probability distributions are normal.

Abstract from the cumulative Normal Distribution Table

<i>Random No.</i>	<i>No. of Deviations from Mean</i>	<i>Random No.</i>	<i>No. of Deviations from Mean</i>
00	-2.5	62-65	0.3
01	-2.3	66-68	0.4
02	-2.0	69-72	0.5
17-18	-0.9	84-85	1.0
19-21	-0.8	86-87	1.1
22-24	-0.7	88-89	1.2
47-53	0.0	96	1.8
54-57	0.1	97	1.9
58-61	0.2	98	2.0
		99	2.3

(J.C.W.A. Final, December 1987)

Solution. (a) Break-Even Volume

Contribution per unit = Rs. 300 - Rs. 175 = Rs. 125

B.E.S. \times P/V ratio = Fixed Cost

\therefore B.E.S. \times (125 \div 300) = Rs. 5,80,000

B.E.S. = Rs. 13,92,000 or 4,640 units

Expected profit = S \times P/V ratio = F + P

= (5,000 \times Rs. 300) \times (125 \div 300) = Rs. 5,80,000 + P

\therefore Profit = Rs. 45,000.

(b) For performing simulation, it is necessary to identify (a) objective functions, (b) critical variables and (c) relationship to the logic of model. Objective is to determine approximate distribution of profit. The critical variables are sales volume, sales price, fixed cost and variable cost. From basic marginal cost equation, following model can be developed.

Profit = Sales Volume (Selling Price - Variable Cost) - Fixed Cost

The simulation can be carried out by randomly selecting a value for each of the four variables, calculating the resultant profit and repeating the process say 100 times, using the data given, the simulated profit figure is calculated as under :

Variable	Expected value	Standard Deviation	Random Nos.	No. of Deviations from mean	Simulation Variable
Sales (unit)	5,000	400	20	-0.8	4,680
Price (Rs.)	300	5	96	1.8	309
Fixed Cost (Rs.)	58,000	10,000	68	0.4	58,400
Variable Cost (Rs.)	175	7.5	59	0.2	176.5

Different values in "Simulated Variable" column are calculated as follows :

Sales (units) = 5,000 - 0.8 (400) = 4,680

Price (Rs.) = 300 + 1.8 (5) = 309

Fixed Cost (Rs.) = 5,80,000 + 0.4 (10,000) = 5,84,000

Variable Cost = 175 + 0.2 (7.5) = 176.5

Profit for simulated sales = 4,680 (309 - 176.5) - Rs. 5,84,000
= Rs. 36,100.

The process would be repeated 100 times to get an approximate profit distribution.

Problem 15-27. (Presentation of problem in LP Format) (a)
Detail the areas in accounting and finance where linear programming may be used with advantage.

(b) Nuton Ltd. manufactures 5 products A B C D and E and the following information is supplied to you.

Per unit of Product in Rs.

	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>
Selling Price	48	42	38	31	27
Material Costs	15	14	16	15	16
Direct Labour	18	16	6	4	4
Fixed Overheads (50% of Direct Labour)	9	8	3	2	2
Total Costs	42	38	25	21	22

Expected maximum unit demand per month for each product at the prices indicated :

<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>
1,500	1,200	900	600	600

Costs of materials include a special component *X* which is in short supply. It costs Rs. 3 per unit. Only 5,800 units will be available in the company during the month. The number of units of *X* needed for a unit of each product is]

<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>
1	2	3	4	5

Labour is paid at a rate of Rs. 1.50 per hour and only 20,000 hours will be available in a month.

The management, for working capital reasons have decided the expenditure on materials should not exceed Rs. 30,000 in a month.

In order to select the best mix of the products *A B C D* and *E*, you are asked to formulate a Linear Programming Model with all details, with the help of the above information, in the usual standardised manner. No solution of the problem is required. (I.C.W.A. Final, December 1987)

Solution : (a) Refer to Advanced Cost and Management Accounting—Text by Saxena and Vashist.

(b) **L P in Standard format**

Step 1—Establish the objective function

Product	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>
Contribution	15	12	16	12	7

Let *A, B, C, D, E* represent No. of products.

Maximise $15A + 12B + 16C + 12D + 7E$

Step 2—Establish Constraints

Demand Constraint :

$$A \leq 1500 \quad B \leq 1200 \quad C \leq 900 \quad D \leq 600 \quad E \leq 600$$

Labour Constraint

In terms of labour hour $12A + 10.67B + 4C + 2.67D + 2.67E \leq 20,000$
(Note—Labour cost per unit has been divided by 1.5).

In terms of Cost : $18A + 16B + 6C + 4D + 4E \leq 30,000$

Material Constraint

For special component $A+B+3C+4D+5E \leq 5800$

The expenditure constraint $15A+14B+16C+15D+16E \leq 3,0000$

The non-negative constraint $A, B, C, D, \& E \geq 0$

The LP formulation is given below :

Maximise $15A+12B+16C+12D+7E$

Subject to $A \leq 1500, B \leq 1200; C \leq 900; D \leq 900; E \leq 600$

$18A+16B+6C+4D+4E \leq 30,000$

$A+B+3C+4D+5E \leq 5,800$

$15A+14B+16C+15D+16E \leq 30,000$

and $A, B, C, D, E \geq 0$

Problem 15-28. (BEP under uncertainty and optimistic and pessimistic budget) (a) A Company has estimated the following demand level of its product :

Sales Volume Units	Probability
10,000	0.10
12,000	0.15
14,000	0.25
16,000	0.30
18,000	0.20

It has assumed that the sales price will be Rs. 6 per unit, marginal cost Rs. 3.50 per unit and fixed cost Rs. 34,000.

What is the probability that :

- the company will be break-even in the period ?
 - the company will make a profit of at least Rs. 10,000
- (b) Frustrated Ltd. observes that its Sales for the past few years and its profits have been around the following figures :

Sales	Rs. 15,00,000
Marginal cost	5,00,000
Contribution	15,00,000
Fixed cost	8,00,000
Profit	2,00,000

In preparing the budget for the next year there is uncertainty about several important points :

- It has submitted offer for two contracts, each to an overseas customer :

	Sales Value
Contract A	Rs. 8,00,000
Contract B	3,00,000

For each of these orders, variable costs (including selling and shipping costs) would be 40% of Sales Value. Total fixed costs would be unaffected by the order. The company hopes to win both orders but thinks it more likely that it will win Contract A but not Contract B.

(ii) A new product is due to be introduced next year. Expected sales are Rs. 30,000 per month with variable costs 50% of sales and fixed costs of Rs. 5,000 per month. The most likely date for introduction of the new product is middle of next year but could be introduced at the end of fourth month or as late at the end of nine month.

(iii) Although it is expected on balance that sale price and costs will not go up, there is a reasonable possibility that variable costs on the current product range will go up by 10%.

Prepare a pessimistic and an optimistic budget of the company for the next year. (I.C.W.A. Final December 1987, C.A. Final, May 1990—Similar)

Solution.

(a) (i) Break Even Sales \times P/V ratio = Fixed Cost

$$\text{or } BES \times [(Rs. 6.00 - Rs. 3.50) \div Rs. 6.00] = Rs. 34,000$$

$$B.E.S. = Rs. 81,600 \quad \text{or } 13,600 \text{ units.}$$

The probability that sales will equal or exceed 13,600 is the probability that sales will be 14,000, 16,000 or 18,000 units which is $0.25 + 0.30 + 0.20 = 0.75$ or 75%

(ii) Sales level required for profit of Rs. 10,000

$$S \times P/V \text{ ratio} = Rs. 34,000 + Rs. 10,000$$

$$S \times [(Rs. 6.00 - Rs. 3.50) \div Rs. 6.00] = Rs. 44,000$$

$$= Rs. 1,05,600 \quad \text{or } 17,600 \text{ unit.}$$

The probability that sales will be equal or above 17,600 units is the probability of sales being 18,000 units which is 0.20 or 20%.

(b) For optimistic and pessimistic budget preparation, various assumptions must be clearly laid down :

(i) Optimistic assumptions

Pessimistic Assumptions

(ii) Win Contract A

Don't Win Contract A

(iii) Win Contract B

Don't Win Contract B

(iv) New Product after 4 months

New product after 9 month

No Change in Cost

Variable Cost up by 10%

Statement showing optimistic and pessimistic budget

	Optimistic	Rs. '000 Pessimistic
Normal sales	1,500	1,500
Less : Variable Cost	500	550
Contribution	1,000	950
Overseas contract sales	800	
Less : Variable Cost 40%	320	
Contribution	480	

New Product				
Sales for 8 months	240			
Sales for 3 month			90	
Less : Variable Cost 50%	120		45	
	<hr/>		<hr/>	
Contribution		120		45
		<hr/>		<hr/>
Total Contribution		1,600		995
Fixed Cost				
New Product	40		15	
Normal	800	840	800	815
	<hr/>	<hr/>	<hr/>	<hr/>
Budgeted Profit		760		180
		<hr/>		<hr/>

Problem 15-29 (Learning Curve) (a) A Company developing a new product makes a model for testing, and then a demonstration model and then goes for regular production. The time taken to make the model is 300 hours and from past experience of similar models, it is known that a 90% learning curve applies. The average time for each of the first two production models will be :

- (1) 270 hours
- (2) 243 hours
- (3) 216 hours
- (4) 219 hours

Support the correct figure with calculation.

(b) A company is considering a contract which will require among other inputs, 50 kg of material *M*. 80 kg of material *M* are in Stock which were purchased for Rs. 1.60 per kg. The replacement price of *M* is Rs. 1.75 per kg. The material is in Stock as a result of a buying error and the company has no other use for it. If not used on this contract, it could be sold for Rs. 1.20 per kg. What is the relevant cost of the material to be used in this contract ?

(c) What are the four aspects of 'Value' which should be considered in a value analysis exercise ? Write a short note on this aspect.

(I.C.W.A. Final, December 1987)

Solution. (a) The learning curve working as follows :

Cumulative Output	Average Time Per Unit	Total Time
1	300	300
2	$300 \times 0.90 = 270$	$270 \times 2 = 540$
4	$270 \times 0.90 = 243$	$243 \times 4 = 972$
8	$243 \times 0.90 = 219$	$219 \times 8 = 1,752$

For third and fourth units produced, average time = $972 - 540 = 432$
i.e. an average of 216 hours.

∴ 3rd is correct answer, 1st, 2nd and 4th answers are wrong.

(b) Relevant cost of material is Rs. 1.20 per kg. The original cost of Rs. 1.60 is irrelevant. Similarly replacement cost of Rs. 1.75 is irrelevant to decision.

(c) Refer to "Advanced Cost and Management Accounting—Text" by Saxena and Vashist.

Problem 15.30. (Probability Application) X Ltd. has to decide between rental of two types of machine manufacturing the same product. Machine A, an inexpensive economy model, rents for Rs. 1,000 per month, but the variable production cost is Rs. 0.25 per unit. Machine B rents for Rs. 3,000 per month but the variable production cost is only Rs. 0.10 per unit. Monthly demand varies between 10,000 and 19,000 according to the following probabilities :

<i>Demand</i>	<i>Probability</i>
10,000	0.12
12,000	0.17
15,000	0.41
17,000	0.24
19,000	0.06

Make a comparison of the two machines. Which machine X Ltd. should rent ? If the demand is definitely known to be 10,000 units, would the decision reverse ?

(ICWA Final, December 1987)

Solution : Expected Cost of Machine A

<i>Demand</i>	<i>Variable Cost</i>	<i>Machine Rental</i>	<i>Total</i>	<i>Probability</i>	<i>Expected Cost</i>
10,000	Rs. 2,500	Rs. 1,000	Rs. 3,500	0.12	Rs. 420.00
12,000	3,000	1,000	4,000	0.17	680.00
15,000	3,750	1,000	4,750	0.41	1947.50
17,000	4,250	1,000	5,250	0.24	1,260.00
19,000	4,750	1,000	5,750	0.06	345.00
Expected Cost					4,652.50
					=====

(c) Expected Cost of Machine B

<i>Demand</i>	<i>Variable Cost</i>	<i>Machine Rental</i>	<i>Total</i>	<i>Probability</i>	<i>Expected Cost</i>
10,000	Rs. 1,000	3,000	Rs. 4,000	0.12	Rs. 480
12,000	1,200	3,000	4,200	0.17	714
15,000	1,500	3,000	4,500	0.41	1,845
17,000	1,700	3,000	4,700	0.24	1,128
19,000	1,900	3,000	4,900	0.06	294
Expected Cost					4,461
					=====

Machine B shows lower expected cost. Therefore Machine B should be rented. If demand is definitely known to be 10,000 units, Machine A should be rented, because its total cost is lower by Rs. 500 i.e. Rs. 4,000—Rs. 3,500.

Problem 15.31 (Probabilistic CVP Analysis with inflation factor) X p.l.c produces a range of products with an average contribution/sales ratio of 30% on current prices. Currently, fixed costs are Rs. 1,50,000 per year and estimates are being prepared for the next budget period for which the following forecasts have been selected

Sales (At current prices)	Probability
Rs. 4,00,000	0.2
Rs. 7,00,000	0.7
Rs. 9,00,000	0.1
	<u>1.00</u>

Inflation rate for the next budget period	Probability
12%	0.3
6%	0.5
2%	0.2
	<u>1.0</u>

The inflation rate is expected to affect all variable costs and 60% of the fixed costs. The company anticipates being able to raise selling prices in line with inflation without losing sales. The probabilities shown are independent.

You are required to : (a) prepare a table of all possible results and calculate the probability of at least breaking even; (b) calculate the probability of making at least a Rs. 70,000 profit. (CIMA, London, May 1989)

(a) *Statement showing all possible results and calculation of probability of atleast breaking even.*

Sales Rs.	P	Inflation rate %	P	Revised CIS ratio (0.30+0.3 of Col 3)	Contribution col 1 × Col 5 Rs.	Factor for adjustment Fixed cost	Revised Fixed cost (Col 7 × 150,000)	Profit (Loss)	Joint Prob- ability
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
4,00,000	0.2	2	0.2	0.306	1,22,400	1.012*	151,800†	(29,400)	0.04
4,00,000	0.2	6	0.5	0.318	1,27,200	1.036	155,400	(28,200)	0.10
4,00,000	0.2	12	0.3	0.336	1,34,400	1.072	1,60,800	(26,400)	0.06
7,00,000	0.7	2	0.2	0.306	2,14,200	1.012	1,51,800	62,400	0.14
7,00,000	0.7	6	0.5	0.318	2,22,600	1.036	1,55,400	67,200	0.35
7,00,000	0.7	12	0.3	0.336	2,35,200	1.072	1,60,800	74,400	0.21
9,00,000	0.1	2	0.2	0.306	2,75,400	1.012	1,51,800	1,23,600	0.02
9,00,000	0.1	6	0.5	0.318	2,86,200	1.036	1,55,400	1,30,800	0.05
9,00,000	0.1	12	0.3	0.336	3,02,400	1.072	1,60,800	1,41,600	0.03

As there is a loss when sale is Rs. 4,00,000, B.E. point starts at sale of Rs. 7,00,000. Therefore probability of atleast break-even = $0.7 + 0.1 = 0.8$. Alternatively the break-even point comes, when the sales goes above 4,00,000 units. The chance of sales being above Rs. 4,00,000 are : $1 - 0.02 = 0.8$.

(*) $0.4 + (1.02 \times 0.6) = 1.012$

†Alternate approach = $90,000 \times 1.04 + 60,000 = \text{Rs. } 1,51,800$; Other values can be found out on the same lines.

(b) Probability of profit being atleast Rs. 70,000 = $0.21 + 0.10 = 0.31$. Alternatively; From table given above it is clear that joint probability is 0.35 at profit level of Rs. 67,200. The cumulative joint probability up to the point is 0.69. The profit goes on increasing afterward. It means probability of profit being about Rs. 70,000 is $1 - 0.69 = 0.31$.

Note. It is necessary to determine joint probability because profit is being influenced by probability of both inflation and sales.

The rate should be arranged in ascending order to facilitate making comparison.

Problem 15-32. (Forecasting contribution using linear regression) CB p.l.c. produces a wide range of electronic components including its best selling item, the Laser Switch. The company is preparing the budgets for 1989 and knows that the key element in the Master Budget is the Contribution expected from the Laser Switch. The records for this component for the past four years are summarised below, with the costs and revenues adjusted to 1989 values:

		1985	1986	1987	1988
Sales	(units)	<u>150,000</u>	<u>180,000</u>	<u>200,000</u>	<u>230,000</u>
Sales revenue	Rs.	292,820	346,060	363,000	448,800
Variable costs		<u>131,080</u>	<u>161,706</u>	<u>178,604</u>	<u>201,160</u>
Contribution		<u>161,740</u>	<u>184,354</u>	<u>184,396</u>	<u>247,640</u>

It has been estimated that sales in 1989 will be 2,60,000 units.

Your are required

- as a starting point for forecasting 1989 contribution, to project the trend, using linear regression;
- to calculate the 95% confidence interval of the individual forecast for 1989 if the standard error of the forecast is Rs. 14,560 and the appropriate t value is 4.303, and to interpret the value calculated; (CIMA London May 1989)

Solution (a) Let x = sales level and y = contribution

Year	x	y	x^2	xy
1985	150	162	22,500	24,300
1986	180	184	32,400	33,120
1987	200	184	40,000	36,800
1988	230	248	52,900	57,040
	<u>760</u>	<u>778</u>	<u>1,47,800</u>	<u>1,51,260</u>

$$b = \frac{n\sum xy - \sum x \sum y}{n\sum x^2 - (\sum x)^2} = \frac{(4 \times 151,260) - (760 \times 778)}{(4 \times 1,47,800) - (760)^2}$$

$$= \frac{6,05,040 - 5,91,280}{5,91,200 - 5,77,600} = \frac{13,760}{13,600} = 1.012$$

$$a = \frac{\sum y - b\sum x}{n} = \frac{778 - 1.012 \times 760}{4} = 2.22$$

At planned output of 260,000 units, the contribution will be

$$2.22 + 1.012 \times 260 = 265.34$$

or Rs. 2,65,340

$$(b) 95\% \text{ confidence limit is } 265.34 \pm 4.303 \times 14.5 = 265.34 \pm 62.39$$

Upper limit = Rs. 327,730 or say Rs. 328,000

Lower Limit Rs. 202,950 or say Rs. 203,000

Problem 15.33. (Contribution Analysis—Joint Probability and Projections with different Price Scenarios) AB Ltd produces a special chemical whose quality is regarded in the market as superior to that of the competition. It has two smaller, but important competitors, CD and EF, who are roughly equal in size to each other. These three companies account for 85% to 90% of the market, with the remainder being supplied by five smaller companies.

For each year, AB Ltd is usually the first to announce its selling price on which contracts with customers for the year are signed. CD, EF and the other competitors then announce their prices.

The recent history of prices (after adjusting for inflation) and sales volume for this market, and the projections for 1989 based on four possible price scenarios, are as follows:

	Price (Rs./kg.)			Sales volume ('000 tonne)			
	AB Ltd.	CD Ltd.	EF Ltd.	Total market	AB Ltd.	CD Ltd.	EF Ltd.
Year to 30 September,							
1985	0.75	0.75	0.75	2.9	1.1	0.8	0.8
1986	0.75	0.75	0.75	3.2	1.5	0.75	0.7
1987	0.75	0.75	0.75	3.7	1.8	0.75	0.8
1988	0.90	0.75	0.75	3.9	1.5	1.0	1.0

Projection for 1989 : Price scenario							
1	0.90	0.90	0.90	3.7	1.8	0.75	0.75
2	0.90	0.90	0.75	3.9	1.5	0.6	1.4
3	0.90	0.75	0.75	4.0	1.3	1.2	1.1
4	0.75	0.75	0.75	4.1	1.8	1.0	0.9

AB Ltd estimates that its costs per kg for this chemical are :

Volume (000 tonnes)

Direct materials cost and wages

Departmental costs:

Directly variable with output

Depreciation

	<u>1.3</u>	<u>1.5</u>	<u>1.8</u>
Rs. per kg	Rs. per kg	Rs. per kg	Rs. per kg
0.273	0.273	0.273	0.273
0.027	0.027	0.027	0.027
0.245	0.212	0.177	

General works overhead (apportioned at $\frac{1}{3}$ direct costs)	0.091	0.091	0.091
Manufacturing costs	0.636	0.603	0.568
Other costs (apportioned at 20% of manufacturing cost)	0.127	0.121	0.114
Total cost	<u>0.763</u>	<u>0.724</u>	<u>0.682</u>

AB Ltd maintains its stocks at the same level from year to year.

For planning purposes, AB Ltd assumes CD's and EF's costs per kg to be equal to its own, though in practice it believes them to be somewhat higher.

AB Ltd also believes that there is a 0.8 probability that CD and EF will adopt a pricing policy that yields the largest profit possible to those companies.

You are required, in respect of 1989, to :

- calculate which of the four scenarios will yield the highest profit possible for (i) CD, (ii) EF;
- recommend, with supporting calculations, whether AB Ltd should charge Re. 0.75 or Re. 0.90 per kg if its objectives are to maximise its profit;
- comment on the other considerations that AB Ltd will need to take into account when making its eventual decision as to the price that it should charge.

(CIMA London May 1989)

Solution : (a) Price scenario yielding the highest profit

Variable cost per kg are Re. $0.273 + 0.027 = \text{Re. } 0.30$

When price is Re. 0.75 per kg, then contribution is Re. 0.45 i.e. $\text{Re. } 0.75 - \text{Re. } 0.30$

When price is Re. 0.90 per kg, then contribution is Re. 0.60 i.e. $\text{Re. } 0.90 - \text{Re. } 0.30$.

(i) For C.D price scenarios will yield these contributions

Scenario	('000 tonnes)	Price/kg	Contribution per kg	Total contribution Rs. in thousand
1	0.75	Re. 0.90	Re. 0.60	450*
2	0.6	0.90	0.60	360
3	1.2	0.75	0.45	540
4	1.0	0.75	0.45	450

* 1,000 Tonnes = 1,000,000 kg

750 Tonnes = 750,000 kg

750,000 kg \times 0.60; other figures computed similarly.

Highest contribution for CD is scenario 3.

(ii) For EF the price scenario will yield the following contributions

Scenario	'00 Tonnes	Price/kg.	Contribution per kg	Total contribution Rs. in thousand
1	0.75	Re. 0.90	Re. 0.60	450
2	1.4	0.75	0.45	630
3	1.1	0.75	0.45	495
4	0.9	0.75	0.45	405

Highest profit possibility for EF is scenario 2.

(b) Using the same basis as part (a) above then 'AB Ltd' position is

Scenario	'000 Tonnes	Price/kg	Contribution per kg	Total contribution Rs. in thousand
1	1.8	Re. 0.90	Re. 0.60	Rs. 1080
2	1.5	0.90	0.60	900
3	1.3	0.90	0.60	780
4	1.8	0.75	0.45	810

AB Ltd. believes there is a 0.8 probability that CD will opt for scenario 3 with a selling price of Re. 0.75 per kg and that EF will opt for scenario 2 with a selling price of Re. 0.75 per kg. These are the two scenarios which yield their highest profits AB Ltd. can decide to charge either Re. 0.75 or Re. 0.90 per kg. If AB Ltd decides on Re. 0.75, then scenario 4 shows both CD and EF to be likely to charge Re. 0.75 per kg. If this occurs then AB Ltd's contribution would be Re. 8,10,000 as shown in the table given above.

If AB Ltd decides on Re. 0.90 per kg, then scenario 1, 2 and 3 all reflect this price with the following probabilities :

Scenario	CD		EF		Combined Probabilities
	Price	Probabilities	Price	Probabilities	
1	Re. 0.90	0.2	Re. 0.90	0.2	* 0.04
2	0.90	0.2	0.75	0.8	0.16
3	0.75	0.8	0.75	0.8	0.80 *
					1.00

* Balance

This gives a probable contribution to AB Ltd. of

Scenario	Combined Probability	Contribution Rs. '000'	Contribution of expected value Rs '000
1	0.04	1080	43
2	0.16	900	144
3	0.80	780	624
			811

The probable contribution of Rs. 8,11,000 with a price of Re. 0.90 per kg is higher than the Rs. 8,10,000 with a price of Re. 0.75 per kg.

Recommendation

AB Ltd. should stay of Re. 0.90 per kg for following reasons :

- (i) This is the price most likely to yield the highest profit.
- (ii) This price in 1987 and 1988 lead to most profitable course :

1987 1800 tonnes @ 0.45 = Rs. 810,000

1988 1500 tonnes @ 0.60 = Rs. 900,000

- (iii) With CD and CF making, or being close to making, a loss and perhaps lacking complete knowledge of AB Ltd's cost. One or both may decide to increase their price to Re. 0.90. This will give AB Ltd a profit equal to or greater than that for 1988.

(c) Considerations AB Ltd needs to take into account when making the pricing decisions.

→ Both CD and EF are moving to a figure of Re. 0.80 or above. Its impact on their market share should be determined.

→ The expected value of AB Ltd's market share is lower at the Re. 0.90 price than at the Re 0.75 price :—

	<i>Total market tonne (000)</i>	<i>AB Ltd share tonne (000)</i>	<i>AB Ltd market share</i>	<i>Cumulative probability</i>	<i>Expected value of market share (%)</i>
Re 0.90 Price					
Scenario 4	4.1	1.8	43.9%	1.00	43.9
Re 0.75 price					
Scenario 1	3.7	1.8	48.6%	0.04	1.9
Scenario 2	3.9	1.5	38.5%	0.16	6.2
Scenario 3	4.0	1.3	32.5%	0.80	<u>26.0</u>
					<u>34.1</u>

This difference of nearly 10% may be of considerable marketing significance. The variable cost may go up over the next year, for example, an increase in wages. This may well reinforce the price of Re 0.90.

Problem 15.34. (Learning curve application to labour cost and project cost). A company is considering investment in a project that will produce one type of product whose total budgeted sales are 120 units at a selling price of Rs. 8,500 per unit.

Sales are to be 20 units in the year to 31 December 1989, 40 units in each of 1990 and 1991, and the balance in 1992. Production will be in line with sales.

Budgeted costs are:

- Direct wages: The first unit will take 2,335 man-hours of work at a wage-rate of Rs. 5.50 per man-hour. An 80% learning curve is expected to operate.
- Direct materials: Rs. 2,000 per unit
- Variable production overhead : 60% of direct wages
- Fixed overhead relating to the project is Rs. 47,500 per annum, including depreciation on new plant to be purchased for the project which is charged on a straight-line method over its life

The new plant will cost Rs. 110,000 payable on 31 December 1988. It will have a life of four years after which it will have no resale value.

For investments of this type, the company requires a return of 16% DCF on the fixed asset investment only.

You are required to

(a) recommend, with supporting calculations, whether the company should proceed with the project if either of the following bases of calculation were used over the four years:

(i) the total quantity of 120 units produced/sold,

or (ii) a year-by-year production/sales schedule;

(b) recommend, with your reasons, which of bases (a) (i) or (a) (ii) above should be used as the criterion for the company's decision;

Ignore tax and inflation.

Note : An 80% learning curve on ordinary graph paper would show the following relationship between the x axis (volume) and y axis (cumulative average cost of elements subject to the learning curve):

x	y %	x	y %
1	100	60	26.77
2	80	70	25.48
10	47.65	80	24.40
20	38.13	90	23.50
30	33.46	100	22.71
40	30.50	110	22.03
50	28.39	120	21.41

(CIMA London May 1989)

Solution: Workings. Statement showing man-hour requirements

Year	Production units	Cumulative production units	Basic Man hours	Learning curve at 80%	Cumulative manhours	Average annual hours	Annual hours
1989	20	20	$20 \times 2335 = 46,700$	38.13%	17,807*	9,998@	17,807
1990	40	60	$60 \times 2335 = 1,40,100$	26.77%	37,505	19,991	19,698#
1991	40	100	$100 \times 2335 = 2,33,500$	22.71%	53,028	19,997	15,523
1992	20	120	$120 \times 2335 = 2,80,200$	21.41%	59,991	9,999	6,961
	120					59,991	59,991

* $46700 \times 0.3813 = 17807$; other figures calculated similarly.

@ $(59991 \text{ Manhours} + 120) \times 20 \text{ units}$; values for other figures computed similarly

$37505 - 17807 = 19698$; Other values computed similarly.

(a) (i) Costs based on average annual hours. (Rs. 000)

Year	Direct Wages	Direct Material	Variable Overhead 60% of D. Wages)	Fixed Depreciation overhead	Total Cost
1989	55*	40**	33	47	(27.5)@
1990	110	80	66	47	(27.5)
1991	110	80	66	47	(27.5)
1992	55	40	33	47	(27.5)
					148
					858

* Average Annual Hours \times Rate per hour = $9,998 \times \text{Rs. } 5.5 = \text{Rs. } 5489$ or Rs. 55,000; other values computed accordingly.

** (a) Production units \times Rate per unit; Rs. 2000 per unit

@ Depreciation, of Rs. 27500 i.e. $1,10,000 \div 4$, does not constitute cash outflow. It is an imputed cost.

Project Evaluation (Rs. '000)

Year	Investment	Product cost	Sales Revenue	Net cash flow	16% DCF	Discounted cash flow
1988	(110)		—	(110)	1.00	(110)
1989		(148)	170	22	0.86	18.92
1990		(276)	340	64	0.74	47.36
1991		(276)	340	64	0.64	40.96
1992		(148)	170	22	0.55	12.10
				<u>62</u>		<u>9.34</u>

(ii) Cost Based on cumulative annual hours (Rs. '000)

Year	Direct Wages	Direct Material	Variable Overhead (60% of wages)	Fixed Overhead	Depreciation	Total Cost
1989	98*	40	59	47.7	(27.5)	217
1990	108	80	65	47.5	(27.5)	273
1991	85	80	51	47.5	(27.5)	236
1992	38	40	23	47.5	(27.5)	121
						<u>847</u>

* $17807 \times \text{Rs. } 5.5 = \text{Rs. } 97938.5$ or 98,000

Project Evaluation (Rs ' 000)

Year	Investment	Production cost	Sales Revenue	Net cash	16% DCF \oplus	Discounted cash flow
1988	(110)		—	(110)	1.00	(110)
1989		(217)	170	(47)	0.86	(40.42)
1990		(273)	340	67	0.74	49.58
1991		(236)	340	104	0.64	66.56
1992		(121)	170	49	0.55	26.95
				<u>63</u>		<u>(7.33)</u>

\oplus Refer to table showing present value of one rupee

(b) Recommendations

Based On the group criterion of 16% DCF return, the evaluation under a(i) shows a positive position and could be proceeded with. Method (ii) shows a negative position and would not be acceptable.

(b) The two concepts incorporated into evaluation are both based on time, that is, the learning curve—the more the experience is gained, the less time is required to produce each unit.

- (ii) Discounted Cash Flow—the value of money is dependent on timing of cash flows. Method a(i) is not relevant for project evaluation. There will be higher actual cash outflows for wages and variable overheads in earlier years. For accuracy this must be reflected in the project evaluation as is done in a(ii).

Recommendation:— Method a(ii) should be used as the basis of the evaluation. On this basis, it would not be an acceptable project to meet the investment policy.

Problem 15.35. (Learning curve application using standard formula). Z p.l.c. experiences difficulty in its budgeting process because it finds it necessary to quantify the learning effect as new products are introduced. Substantial product changes occur and result in the need for retraining.

An order for 30 units of a new product has been received by Z p.l.c. So far, 14 have been completed; the first unit required 40 direct labour hours and a total of 240 direct labour hours has been recorded for the 14 units. The production manager expects an 80% learning effect for this type of work.

The company uses standard absorption costing. The direct costs attributed to the centre in which the unit is manufactured and its direct material costs are as follows :

Direct material	Rs. 30.00 per unit
Direct labour	Rs. 6.00 per hour
Variable overhead	Rs. 0.50 per direct labour hour
Fixed overhead	Rs. 6,000 per four-week operating period

There are ten direct employees working a five-day week, eight hours per day. Personal and other downtime allowances account for 25% of the total available time.

The company usually quotes a four-week delivery period for orders.

You are required to

- determine whether the assumption of an 80% learning effect is a reasonable one in this case, by using the standard formula $y = ax^b$
 where y = the cumulative average direct labour time per unit (productivity)
 a = the average labour time per unit for the first batch
 x = the cumulative number of batches produced
 b = the index of learning
- Calculate the number of direct labour hours likely to be required for an expected second order of 20 units;
- use the cost data given to produce an estimated product cost for the initial order, examine the problems which may be created for budgeting by the presence of the learning effect. (CIMA London May 1989)

Solution.

- For an 80% learning curve, the index of learning is given by :

$$b = \frac{\text{logarithm of learning ratio}}{\text{logarithm of 2}} = -0.3222$$

We know that $Y_x = ax^b$

$$\text{or } \log Y_x = \log a + b \log x$$

$$\begin{aligned}\text{or } \log Y_{14} &= \log 40 + (-0.322) (\log 14) \\ &= 1.6021 + (-0.322) (1.1461) \\ &= 1.6021 - 0.3692 \\ &= 1.233\end{aligned}$$

$$Y_{14} = 17.14 \text{ hours per unit}$$

\therefore Average productivity for just 14 units will be = 17.14 hours per unit

$$\text{Time taken for 14 units} = 14 \times 17.14 = 239.96.$$

It means that the assumptions is correct.

ii) Applying the 80 % learning curve :

Productivity at 50 units output

$$= 40 \times 50^b$$

$$\begin{aligned}\text{Or } \log Y_{50} &= \log 40 + (-0.322) (\log 50) \\ &= 1.6021 + (-0.322) (1.6990) \\ &= 1.6021 - 0.5471 = 1.0550\end{aligned}$$

or Productivity at 50 units = 11.35 hour per unit

$$\text{Direct labour hours required for 50 units} = 50 \times 11.35 = 567.5 \text{ hours}$$

Productivity at 30 units =

$$\begin{aligned}\log Y_{30} &= \log 40 + (-0.322) (\log 30) \\ &= 1.6021 + (-0.322) (1.4779) \\ &= 1.6021 - 0.4759 \\ &= 1.1262\end{aligned}$$

Productivity at 30 units = 13.38 hour per unit

$$\text{Direct labour hours required at 30 units} = 30 \times 13.38 = 401.4 \text{ hours.}$$

$$\text{Time for units 31 to 50} = 567.5 - 401.4 = 166.1 \text{ hour}$$

(iii) Hours taken for 30 units = 402 hours

Cost of order

Material 30×30	=	Rs. 900
Labour $402 \times \text{Rs } 6$	=	2412
V. Overhead $402 \times \text{Rs. } 0.50$	=	201
Fixed Overhead $402 \times \text{Rs. } 5^*$	=	<u>2010</u>
		<u>5523</u>

$$\text{Cost per unit Rs. } 5523 \div 30 = \text{Rs. } 184.1$$

***For Fixed Overhead rate**

Total labour hours for 4 week period

$$= 10 \text{ workers} \times 5 \text{ days} \times 8 \text{ hrs} \times 4 \text{ weeks} = 1600 \text{ hours.}$$

$$\text{Less nonproductive time } 25\% = 400 "$$

$$\text{Effective hours} = 1200 \text{ hours}$$

$$\text{Fixed overhead rate} = \text{Rs. } 6000 \div 1200 = \text{Rs. } 5 \text{ per direct labour hour}$$

It should be noted that *cost per unit* for the first 14 units is :

$$\text{Material} \quad \text{Rs. } 30.00$$

$$\text{Labour \& Overhead. } 240 \times (\text{Rs. } 6.00 + \text{Rs. } 5.00 + \text{Rs. } 0.50)$$

$$\{ 240 \times (\text{Rs. } 6.00 + \text{Rs. } 5.00 + \text{Rs. } 0.50) \} \div 14 = 197.14$$

This example illustrates that product cost varies with the quantity. Therefore, budgeting process must consider the extent learning effects. To meet this need can lead to a number of problems such as possibility of over cost estimates and in planning the resource requirements.

Problem 15-36. (Determining Cost-Price relationship using exponential function). U p.l.c. is one of a number of companies, selling a similar product, operating in a particular market.

U p.l.c. has developed a new production process that would enable it to expand output and to reduce unit cost. These two aspects are inter-dependent. Unit costs can be reduced only if output is increased.

U p.l.c. is hoping to stimulate additional demand through an alteration in prices. Financial data relating to U p.l.c.'s current and anticipated position are as follows :

Current cost structure

Variable costs Re. 0.20 per unit

Fixed costs Rs. 100,000 per annum

U p.l.c.'s current annual trading profit is given by the function:

$$\text{Trading profit} = [\text{quantity} \times \text{price}]^{0.8} - [\text{Rs. } 100,000 + (\text{quantity} \times \text{Re. } 0.20)]$$

*0.8 is an exponential function.

This function applies when

Quantity = 8.5 million tonnes to 11 million tonnes (both inclusive)

Price = Rs. 9.00 per tonne to Rs. 10.50 per tonne (both prices inclusive)

Anticipated cost structure if the new production process is used

Variable costs Re. 0.15 per unit

Fixed costs Rs. 400,000 per annum

U p.l.c.'s anticipated annual trading profit will be given by the function:

$$\text{Trading profit} = [\text{quantity} \times \text{price}]^{0.8} - [\text{Rs. } 400,000 + (\text{quantity} \times \text{Rs. } 0.15)]$$

0.8 is an exponential function.

This function will apply when quantity is in excess of 11 million tonnes and output is priced at Rs. 9.00 or less per tonne.

- You are required to determine whether it would be to U p.l.c.'s advantage to start using the new production process. (CIMA London May 1989)

Solution

The given data for the company affords the opportunity to test some possible outcomes. For example, if both the minimums are selected, the outcome will be as follows:

$$\begin{aligned} &= (\text{Rs. } 85,00,000 \times \text{Rs. } 9)^{0.8} - (\text{Rs. } 1,00,000 + (85,00,000 \times 0.25)) \\ &= \text{Rs. } 20,27,352 - \text{Rs. } 18,00,000 \\ &= \text{Rs. } 2,27,352 \text{ trading profit under current cost structure} \end{aligned}$$

In the same calculations are repeated for the remaining variables the following results are observed:

Price	Quantity	Trading Profit
Rs. 10.50	8,00,00,000	Rs. 92,436
Rs. 9.00	1,10,00,000	Rs. 91,771
Rs. 10.50	1,10,00,000	Rs. 18,809

Therefore, this company can achieve a profit ranging from Rs. 1,91,771 to Rs. 92,436 at an output of 1,10,00,000 tonnes and a price of Rs. 10.50 being the lowest and Rs. 9.00 the highest profit.

If the new process is implemented for a quantity of 1,10,00,000 tonnes and a price of Rs. 10.50, the trading profit would be:-

$$\begin{aligned} &= (1,10,00,000 \times \text{Rs. } 10.50)^{0.8} - [4,00,000 + (1,10,00,000 \times 0.15)] \\ &= \text{Rs. } 24,89,556 - (\text{Rs. } 4,00,000 + 16,50,000) \\ &= \text{Rs. } 4,39,556 \text{ profit} \end{aligned}$$

This outcome is inferior to the previous and suggests that the new process is not worthwhile. If a higher level of output is selected, then increased profits are obtainable i.e. sales of 1,50,000,000 would give a profit of Rs. 5,40,662.

It is necessary for the company to explore the profitability of different outputs and to assess the likelihood of their attainment.

Problem 15-37 (Use of Linear Regression Equation for estimation). SV Ltd. manufactures a variety of products at its industrial site in Wagle. One of the products, the LT, is produced in a specially equipped factory in which no other production takes place. For technical reasons the company keeps no stocks of either LTs or the raw material used in their manufacture. The costs of producing LTs in the special factory during the past four years have been as follows:

	1987	1988 (In Rupees)	1989	1990 (estimated)
Raw Materials	70,000	100,000	130,000	132,000
Skilled labour	40,000	71,000	96,000	115,000
Unskilled labour	132,000	173,000	235,000	230,000
Power	25,000	33,000	47,000	44,000
Factory overheads	<u>168,000</u>	<u>206,000</u>	<u>246,000</u>	<u>265,000</u>
Total production costs	<u>435,000</u>	<u>583,000</u>	<u>754,000</u>	<u>786,000</u>
Output (units)	160,000	190,000	220,000	180,000

The costs of raw materials and skilled and unskilled labour have increased steadily during the past four years at an annual compound rate of 20%, and the costs of factory overheads have increased at an annual compound rate of 15% during the same period. Power prices increased by 10% on 1st January 1988 and by 25% on the 1st January of each subsequent year. *All costs except power are expected to increase by a further 20% during 1991.* Power prices are due to rise by 25% on 1st January, 1991.

The Directors of SV Ltd. are now formulating the Company's production plan for 1991 and wish to estimate the costs of manufacturing the product LT. The Finance Director has expressed the view that *'the full relevant cost of producing LTs can be determined only if a fair share of general Company overheads is allocated to them.'* No such allocation is included in the table of costs above.

You are required to use linear regression analysis to estimate the relationship of total production costs to volume for the product LT for 1991 (ignore general Company overheads and taxation and do not undertake a separate regression calculation for each item of cost). Analysis to be done after converting all costs to 1991 basis.

(ICWA Final June 1989, CIMA London May 1982)

Solution: It is given in the question that raw materials, skilled and unskilled labour have increased steadily over the past four years. Total of these items is worked out as under:

	(Rs. '000)			
	1987	1988	1989	1990
Raw materials	70	100	130	132
Skilled labour	40	71	96	115
Unskilled labour	<u>132</u>	<u>173</u>	<u>235</u>	<u>230</u>
Total	<u>242</u>	<u>344</u>	<u>461</u>	<u>477</u>

	(Rs. '000)			
	1987	1988	1989	1990
Raw materials skilled labour and unskilled labour	242(1.2) ⁴ = 501.81	344(1.2) ³ = 594.43	461(1.2) ² = 663.84	477(1.2) = 572.40
Factory overhead	168(1.15) ³ (1.2) = 306.61	206(1.15) ² (1.2) = 326.92	246(1.15)(1.2) = 339.48	265(1.2) = 318.
Power	25(1.1)(1.25) ³ = 53.71	33(1.25) ³ = 64.45	47(1.25) ² = 73.44	44(1.25) = 55
Total cost (1991) prices.	<u>862</u>	<u>986</u>	<u>1077</u>	<u>945</u>
Output ('000) units.	160	190	220	180

The equation is $y = a + bx$

The above data is tabulated below for finding out the regression equation:

Output (‘000 units)	Total cost Rs. ‘000	(‘000 units)	(Rs. ‘000)
x	y	x^2	xy
160	862	25,600	1,37,920
190	986	36,100	1,87,340
220	1077	48,400	2,36,940
180	945	32,400	1,70,100
$\Sigma x = 750$	$\Sigma y = 3870$	$\Sigma x^2 = 142,500$	$\Sigma xy = 732,300$

Solving by normal regression equation :

$$\Sigma y = Na + b \Sigma x$$

$$\Sigma xy = a \Sigma x + b \Sigma x^2$$

$$3,870 = 4a + 750b \quad (i)$$

$$732,300 = 750a + 142,500b \quad (ii)$$

$$735,300 = 760a + 1,42,500b \dots \text{(By multiplying (i) by 190)} \quad (iii)$$

By solving the equations (ii) & (iii) $a = 300$, $b = 3.56$

The relationship between total production costs to volume for 1991 is:

$$y = \text{Rs. } 3,00,000 + 3.56x$$

Problem 15.38. (Minimax and Maximin criteria for Decision Making). New Horizons Ltd. wants to go in for a public share issue of Rs. 10 lakhs (1 lakh shares of Rs. 10 each) as a part of its effort to raise capital needed for its expansion programme. The Company is optimistic that if the issue were made now, it would be fully taken up at a price of Rs. 30 per share.

However the Company is facing two crucial situations, both of which may influence the share prices in the near future, namely:

- An impending wage dispute with assembly workers which could lead to a strike in the whole factory could have an adverse effect on the share price.
- The possibility of a substantial business in the export market, which would increase the share price.

The four possible events and their expected effect on the Company's share prices are envisaged as—

- E1 : No strike and export business obtained—**
Share Price rises to Rs. 34.
- E2 : Strike and export business obtained—**
Share Price stays at Rs. 30.
- E3 : No strike and export business lost—**
Share Price hovers around Rs. 32.
- E4 : Strike and export business lost—**
Share Price drops to Rs. 16.

And the management has identified three possible strategies that the Company could adopt; viz.,

S1 : Issue 1,00,000 shares now.

S2 : Issue 1,00,000 shares only after the outcome of (a) & (b) are known.

S3 : Issue 50,000 shares now and 50,000 shares after the outcome of (a) & (b) are known

You are required to

- draw up a pay off table for the Company and determine the minimax[®] regret solution. What alternate criteria might be used ?
- determine the optimum policy for the Company using the criterion of maximising expected pay-off, given the estimate that the probability of a strike is 55% and there is a 65% chance of getting the export business, these probabilities being independent.
- determine the expected value of perfect information for the Company.

(ICWA Final June 1989)

Solution :

Statement showing Pay off Table (Rs. in lakhs)

Event → Strategies ↓	E1	E2	E3	E4
S1	30	30	30	30
S2	34	30	32	16
S3	32	30	31	23

Note :— The S3 row has been obtained out as follows

E1— $50,000 \times 30 + 50,000 \times 34 = \text{Rs. } 32,00,000$

E2— $1,00,000 \times \text{Rs. } 30 = \text{Rs. } 30,00,000$

E3— $50,000 \times 30 + 50,000 \times 32 = \text{Rs. } 31,00,000$

E4— $50,000 \times 30 + 50,000 \times 16 = \text{Rs. } 23,00,000$

From Pay off tables regret table has been obtained.

	E1	E2	E3	E4	Max Regrets
S1	4	0	2	0	4
S2	0	0	0	14	14
S3	2	0	1	7	7

Minimax regret solution is S₁ i.e. 4. Alternatively, include Maximin i.e. Strategy with highest minimum pay off to which is S₁ i.e. 30.

Maximax is highest pay off strategy S₂ i.e. 34

(ii) maximising expected pay off:

Probability of outcome are not given directly but can be easily calculated:

E1	0.45	×	0.65	=	0.2925
E2	0.55	×	0.65	=	0.3575
E3	0.45	×	0.35	=	0.1575
E4	0.55	×	0.35	=	0.1925

	E1	E2	E3	E4	Expected Pay off
S1	30×0.2925	30×0.3575	30×0.1575	30×0.1925	30
S2	34×0.2925	30×0.3575	32×0.1575	16×0.1925	28.79
S3	32×0.2925	30×0.3575	31×0.1575	23×0.1925	29.40

S1 has the highest expected pay off i.e. 30 (Rs. 30 lakhs)

(iii) The expected value of the perfect information is the difference between expected pay off of 30 lakhs and the amount which would be achieved if outcomes are known in advance.

	Max pay off	Probability	Expected pay off with perfect information
E1	34	0.2925	9.94
E2	30	0.3575	10.72
E3	32	0.1575	5.04
E4	30	0.1925	<u>5.78</u>
			<u>31.48</u>

Expected value of perfect information = $31.48 - 30 = 1.48$
or Rs. 148,000

Notes: For first table find out the values of different events for different strategies.

Learning Curve—P 15-1, 15-2, 15-3, 15-4, 15-16, 15-29, 15-34, 15-35, A 131, A141

Probability—P 15-5, 15-6, 15-7, 15-9, 15-10, 15-12, 15-13, 15-15, 15-17, 15-18, 15-20, 15-25, 15-28, 15-30, A 127, A146

CVP Analysis under uncertainty—P15-8, 15-23, 15-31, 15-33, A128, A139, A155

Simulated Variables—P 15-26, A 96

Coefficient of Multiple Correlation P15-11, 15-32, 15-37

Linear Programming—P15-14, 15-22, 15-24, 15-27, 15-38, A94

Exponential function—P 15-36

Stock Levels A143

Miscellaneous A158

Please also refer to examples 20-1 to 20-24 of the book "Advanced Cost and Management Accounting—Text" by Saxena and Vashist.

Production, Productivity and Cost Effectiveness*

Optimising production by introducing overtime

Problem 16.1. A department of a Company has to process a large number of components per month. The process equipment time required is 36 minutes per component, whereas the requirement of an imported process chemical is 1.2 litres per component. The manual skilled manpower required is 12 minutes per component for polishing and cleaning. The following additional data is available :

	<i>Availability per month</i>	<i>Efficiency of Utilisation</i>
Equipment hours	500	85%
Imported chemical in litres	1000	95%
Skilled manpower hours	250	65%

- (i) What is the maximum possible production under the current condition ?
 (ii) If skilled manpower availability is increased by overtime by 20%, will it result in increase of production ?

(I.C.W.A. Inter, June 1987)

Solution (i) Statement showing maximum possible production under the current conditions

	<i>Availability per month</i>	<i>Efficiency of utilisation</i>	<i>Effective utilised</i>	<i>Require- ment per component</i>	<i>Maximum Production</i>
Equipment hours	500	85%	425	0.6	708
Imported chemical in litres	1,000	95%	950	1.2	792
Skilled Manpower hours	250	65%	162.5	0.2	813

Based on above working, a maximum of 708 components can be produced because equipment hours is the main limiting factor.

(ii) Even if the availability of skilled manpower is increased by overtime by 20%, it will not result in increase of production, because equipment hours are available for only 708 components. Even available

* This chapter is relevant to Intermediate level only.

skilled man hours cannot be fully utilized. Skilled manhours are available even without overtime for 813 components where as a maximum of 708 components can be produced due to constraint of equipment hours.

Viability of Incentive Scheme

Problem 16.2. A product is manufactured at the rate of 200 units per day and sold for Rs. 8 each. Direct material cost is Rs. 2 per unit and direct labour cost is Re. 1 per unit. Overheads (including selling) are Rs. 800 per day. If the selling price can be reduced by Re. 1 per unit, it is expected that 50% more units can be sold. The workmen are prepared to produce 50% more only if there is a proportionate increase in their earnings. A suitable Incentive Scheme would cost Rs. 100 per day to administer. With appropriate calculations justify if the Company should go in for such an Incentive Scheme.

(I.C.W.A. Inter, June 1987)

Solution. Statement showing profit without Incentive Scheme

Sales value (200 units \times Rs. 8)		Rs. 1,600
Less : Cost of production :		
Direct material	200 \times 2 = Rs. 400	
Direct labour	200 \times 1 = 200	
Overheads (including Selling)	800	
	---	1,400
Profit		200

Statement showing profit with Incentive Scheme

Sales value	300 \times Rs. 7	= Rs. 2,100
Less : Cost of production :		
Direct materials	300 \times 2 = Rs. 600	
Direct labour	300 \times 1 = 300	
Overheads (including cost of Incentive Scheme)	900	1,800
Profit		300

Note. The company should go in for the proposed incentive scheme as it yields higher profit for the company. This scheme is beneficial to the workmen. The consumers are also benefited by lower selling price.

Scanlon Plan of incentive bonus

Problem 16.3. Fair Play Co., Ltd. has introduced Scanlon plan of incentive bonus for its employees in 1987 on the following information relating to previous three years :

Year	Sales Revenue	Total Salaries and Wages
1984	Rs. 1,20,000	Rs. 36,000
1985	1,25,000	35,000
1986	1,35,000	35,100

For 1984, the sales revenue has been Rs. 1,50,000 and total salaries and wages payment has been Rs. 36,000. What is the amount due as bonus to the employees according to Scanlon Plan ?

If 30% is set aside in a bonus equalisation fund, how much money is available to be paid out as Scanlon Plan for 1987 ?

(I.C.W.A. Inter (R.S.), June 1985, June 1987, and June 1988 Similar)

Solution. Average annual salaries and wages

$$= \frac{\text{Rs. } 36,000 + 35,000 + 35,100}{3} = \text{Rs. } 35,367$$

Annual average sales revenue

$$= \frac{\text{Rs. } 1,20,000 + 1,25,000 + 1,35,000}{3} = \text{Rs. } 1,26,667$$

Bonus percentage $\frac{\text{Average Annual Salaries \& Wages}}{\text{Average Annual Sales Revenue}} \times 100$

$$= \frac{35,367}{1,26,667} \times 100 = 27.92\%$$

Salaries and wages on which bonus is applicable

(Rs. 36,000 \times 27.92%)

Rs. 41,880

Actual Salaries and wages for 1987

36,000

Bonus Fund

5,880

30% for Bonus Equalisation Fund

1,764

Bonus available for disbursement

4,116

Impact of Air-conditioning on productivity

Problem 16'4. Studies conducted by a management consultant in XYZ company indicate that the annual office air-conditioning costs about 1% of the annual payroll for each 100 square metre of air-conditioned floor space per worker. Each sales personnel requires an average of 200 sq. metre of air-conditioned space. The total annual costs include depreciation also. It is estimated that air-conditioning may boost output by 5% when it is effective. Air-conditioning will be effective between May and October only. If so, should the office be air-conditioned

(C.A. Final, May 1980)

Solution. Productivity = $\frac{\text{Output}}{\text{Input}}$

Let the existing input be 100 and output be 90

Present productivity = $90 \div 100 = 0.90$

Proposed productivity

Proposed input = 100 + 1% for each 100 sq. metre

i.e. 100 + (2% for each 200 sq. metre)

(viz., 4 for full year or 2 for half year $100 + 2 = 102$)

Proposed output $90 + 5\%$ of 90 for full year or 2.25% for half year
 $90 + 2.25 = 92.25$

Proposed productivity $= \frac{92.25}{102} = 0.9044$

The proposed productivity is more than the present productivity. Therefore office should be air-conditioned.

Productivity linked Incentive Bonus

Problem 16.5. Workmen of a particular grade working on 8 hour shift duty are guaranteed a wage of Rs. 32. An incentive scheme is in operation according to which production bonus is earned directly proportional to performance but only after 100% performance is reached. Four workmen A, B, C and D produce 48, 60, 75 and 90 units respectively in 6 hours spent in working on a job which has a standard time of 6 minutes per unit as measured work content. Remaining 2 hours of the shift are spent in doing unmeasured work for which no incentive bonus can be paid. Find for each workman.

- (i) the production performance level achieved
 (ii) total earning for the day. (I.C.W.A. Inter, Dec. 1984—R.S.)

Solution. (i) For 8 hours guaranteed wages = Rs. 32

For 1 hour guaranteed wages = Rs. 4

In 6 minutes standard production = 1 unit

In 6 hours standard production = $(1 \div 6) \times 6 \times 60$ or 60 units.

It means that if a worker produces 60 units, his performance is 100%.

So the standard performance levels of all the workers will be :

	Actual production	Performance level (Standard = 60 units)
A	48	$(48 \div 60) \times 100 = 80\%$
B	60	$(60 \div 60) \times 100 = 100\%$
C	75	$(75 \div 60) \times 100 = 125\%$
D	90	$(90 \div 60) \times 100 = 150\%$

(ii) **Total earning for the day**

	A	B	C	D
Earning on measured work (6 hours @ Rs. 4 per hour)	Rs. 24	Rs. 24	Rs. 24	Rs. 24
Bonus (over 100% performance)	—	—	6*	12**
Earning on unmeasured work (2 hrs. @ Rs. 4 per hour)	8	8	8	8
Total earning for the day	32	32	38	44

*25% of Rs. 24

**50% of Rs. 24

Computation of Group Incentive/

Problem 16.6. The targeted weekly output of a manufacturing unit employing 20 workers is 400 pieces. The group is entitled to earn an incentive @ 10% on the aggregate of wages based on basic piece rate plus dearness allowance (which is Rs. 120 per week) upon achievement of a minimum of 80% of the output target. This incentive rate increases by $2\frac{1}{2}\%$ flat for every 10% increase in achievement of targets up to a maximum of 10% at the level of 120% of the output target in the following manner :—

<i>Output Target</i>	<i>Incentive Rate</i>
80% — 90	10%
90% — 100%	12½%
100% — 110%	15
110% — 120%	17½%
120% and above	20%

During the four weeks in February, the actual output achieved by the workers is 383 pieces, 442 pieces, 350 pieces and 318 pieces respectively. The average basic rate is Rs. 5.

Compute the amount of incentive earned by the group during each of the four weeks. (ICWA Inter., Dec 1985)

Solution. Computation of the amount of incentives during four weeks of February.

<i>Particulars</i>	<i>Weeks</i>			
	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>
1. Actual output achieved	383	442	350	318
2. Standard output	400	400	400	400
3. Performance target				
$\frac{\text{Actual output}}{\text{Std. output}} \times 100$	95.75%	110%	87.5%	79.5%
4. Entitlement of incentive rate	12.5%	17.5%	10%	Nil
5. Wage rate per piece	Rs. 5	Rs. 5	Rs. 5	Rs. 5
6. Wages for actual output	1,915	2,210	1,750	1,590
7. Dearness allowance	120	120	120	120
8. Wages including D.A.	2,035	2,330	1,870	1,710
9. Incentive earned (col. 4 multiplied by col. 8)	254.38	407.75	187.00	--

Scanlon Plan.

Problem 16: 6A Good Eagle Co Ltd. has introduced a Scanlon Plan of Incentive Bonus for its employees from 1987. The relevant information for the three previous years are as follows :—

Year	Sales Revenue	Total Salaries & Wages
1984	Rs. 2,40,000	Rs. 72,000
1985	Rs. 2,50,000	Rs. 70,000
1986	Rs. 2,70,000	Rs. 86,400

For 1987, the sales revenue has been Rs. 3,25,000 and the total salaries and wages paid Rs. 90,000. What is the amount due to employees under the Scanlon Plan? If 50% is set aside in a bonus equalisation reserve fund, how much money is to be paid out for 1987 as scanlon bonus? (I.C.W.A. Inter June 1988)

Solution.

Average Annual Salaries and Wages.

$$= \frac{\text{Rs. } 72,000 + 70,000 + 86,400}{3} = 76,133.33$$

Average Annual Sales Revenue

$$= \frac{\text{Rs. } 2,40,000 + \text{Rs. } 2,50,000 + \text{Rs. } 2,70,000}{3} = 2,53,333.33$$

$$\text{Bonus percentage} = \frac{\text{Average Annual Salaries \& wages}}{\text{Average Annual Sales Revenue}} \times 100$$

$$= \frac{76,133.33}{2,53,333.33} \times 100 = 30.05\%$$

salaries and wages on which bonus is
applicable (3,25,000 × 30.05%)

= Rs. 97,663

Actual Salaries and Wages for 1987

= 90,000

Bonus Fund

7,663

50% for Bonus Equalisation Fund

3,832

Bonus available for disbursement

3831

Executive incentive scheme for cost reduction

***Problem 16.7.** Arun Chemical Industries has been trying various cost reduction plans. However, it has achieved limited success. As a part of its constant endeavour in this area, it thought of motivating managers to cut costs through an incentive scheme.

A newly appointed Administration Manager has put up an Executive Incentive Scheme for perusal of the management. The scheme is based on USSR pattern where the reward to Managerial Staff is linked with the both, the increase in profits and increment in return on investment.

The Administration Manager put forth the following formula for calculation of bonus which is to be distributed amongst all managers in proportion to their basic salary.

$$\begin{aligned}
 (i) \quad & \text{Total Bonus} = SB \\
 (ii) \quad & B = X + Y \\
 (iii) \quad & X = \left(\frac{T - T_1}{T} \right) i \\
 (iv) \quad & Y = \frac{T}{I} j
 \end{aligned}$$

Here (1) S Total Salary Fund to be decided by management. (2) B Bonus Factor. (3) T profit for the year for which bonus is to be paid, (4) T_1 profit for previous year. (5) I Average gross value of investment. (6) i and j are multiplier factors to be decided by management for proper adjustment of bonus so that adequate amount is arrived at to motivate managers. The profit to be considered for calculation of bonus will be profits before tax but after allowing interest at 6% on gross value of investment at the end of the year.

You are required to calculate the total amount of bonus under the above scheme assuming following data :

- (1) Total Salary Fund (S) = Rs. 5 lacs.
- (2) Profit after 40% Tax = Rs. 2.1 lacs for previous year.
- (3) Profit after 40% tax = Rs. 3.0 lacs for current year.
- (4) Average gross investment = 25 lacs for current year.
- (5) Interest deducted at 15% on Gross Investment at the end of current and previous year.
- (6) Factors i and j are 10% and 20%, respectively.
- (7) The gross investment at current year end is more by Rs. 5 lacs as compared to previous year. (I.C.W.A. Final, June 1986)

Solution. Average gross investment = Rs. 25 lacs for current year. It is given that interest is deducted at 15% on gross investment at the end of current and previous year. Therefore, it is necessary to find our gross investment for these years. Suppose the gross investment for previous year = X .

Avg. gross investment = $\frac{\text{Gross investment for previous year} + (\text{Gross Investment for previous year} + 5)}{2} = 25$

$$= \frac{x + (x + 5)}{2} = \text{Rs. 25 lakhs.}$$

$$= 2x = \text{Rs. 50} - 5 \quad \text{or} \quad x = \text{Rs. 22.50 lakhs.}$$

Gross investment for previous year = Rs. 22.50 lakhs.

Gross investment for current year end is more by Rs. 5 lacs as compared to previous year. Therefore gross investment at current year end = Rs. 27.50 lakhs.

T = Profit for the current year for which bonus is to be paid.

T_1 = Profit for the previous year

So, it is necessary to find out the current year's profit and previous year's profit for calculation of bonus.

Profit for current year

Profit after 40% tax	= Rs. 3 lacs
Profit before tax = 3 lacs \div 60%	or Rs. 5,00,000
Add : 15% interest on gross investment (Rs. 27.50 lakhs) =	4,12,500
	<hr/>
	9,12,500
Less : Interest allowed @ 6% on Rs. 27.50 lakhs	1,65,000
	<hr/>
Profit for current year for bonus purpose	7,47,500

Profit for previous year

Profit after 40% tax	= Rs. 2,10,000
Profit before tax = 2,10,000 \div 60%	3,50,000
Add : Interest @ 15% on Rs. 22.50 lakhs	= 3,37,500
	<hr/>
	6,87,500
Less : Interest allowed @ 6% on Rs. 22.50 lakhs	1,35,000
	<hr/>
Profit for previous year for purpose of bonus	5,52,500

Calculation of total amount of bonus

$$B \text{ (Bonus)} = X + Y$$

\therefore We have to find out their values

$$X = \left(\frac{T - T_1}{T_1} \right) i = \left(\frac{\text{Rs. 7,47,500} - \text{Rs. 5,52,500}}{5,52,500} \right) \times 10\%$$

$$= 0.0352941$$

$$Y = \frac{T}{T} i = \frac{\text{Rs. 7,47,500}}{25,00,000} \times 20\% =$$

$$0.0589$$

$$B = X + Y$$

$$= 0.0950941$$

$$\text{Total Bonus} = SB = (\text{Rs. 5,00,000}) \times (0.0950941) = \text{Rs. 47,547.05}$$

$$= \text{Rs. 47,547.05}$$

Fast repairman vs. Slow repairman

Problem 16.8. (a) A repairman is to be hired to repair machines that breakdown following a Poisson process with an average rate of four per hour. The cost of non-productive machine is Rs. 9 per hour. The company has the option of choosing either a fast repairman or a slow repairman. The fast repairman charges Rs. 6 per hour and will repair machines at an average rate of 7 per hour. The slow repairman charges Rs. 3 per hour and will repair machines at an average rate of 5 per hour. Which repairman should be hired?

(b) Explain the terms "normal time" and "standard time". If normal time to do a job is 2 minutes and the total allowances is 20%, what are the ways to compute the standard time? Account for the differences in the computed values of standard time. (C.A. Final, May 1985)

Solution :

(a) Rate of arrival of machines for repairs per hour = 4

Cost of non-productive machine per hour = 9

Total cost of repairs per hour

= Cost for waiting time + wages per hour

Cost for waiting time

= Non-productive cost per hour

$$\times \left(\frac{\text{Rate of arrival} \div \text{Avg. Rate of repair}}{1 - (\text{Rate of arrival} \div \text{Avg. rate of repairs})} \right)$$

Fast Repairman. (Wages = Rs. 6 per hour and will repair 7 machines per hour)

$$= \text{Rs. } 9 \left(\frac{4 \div 7}{1 - (4 \div 7)} \right) + \text{Rs. } 6$$

$$= \left(9 \times \frac{4}{7} \times \frac{7}{3} \right) + \text{Rs. } 6 \text{ or Rs. } 18 \text{ per hour}$$

Slow Repairman (Wages = Rs. 3 per hour and will repair 5 machines per hour)

$$= \text{Rs. } 9 \left(\frac{4 \div 5}{1 - (4 \div 5)} \right) + \text{Rs. } 3$$

$$= \left(9 \times \frac{4}{5} \times \frac{5}{1} \right) + \text{Rs. } 3 \text{ or Rs. } 39 \text{ per hour.}$$

The fast repairman should be engaged as the total repair cost per hour is substantially lower than that of slow repairman.

(b) (i) Normal time = 2 minutes

Total allowance = 20%

Standard time = Normal time (1 + allowance)

$$= 2 (1 + 0.20)$$

$$= 2.40 \text{ minutes}$$

$$(ii) \text{ Standard time} = \frac{\text{Normal time}}{(1 - \text{allowance})} = \frac{2}{0.80} \text{ or } 2.50 \text{ minutes}$$

Difference

$$2:50 \text{ minutes} - 2:40 \text{ minutes} = 0:10 \text{ minute}$$

In 8 hours or 480 minutes, a worker should produce $480 \div 2:40 = 200$ units as per first formula.

$$\text{i.e., } 200 \text{ units} \times 2 \text{ minutes} = 400 \text{ minutes working time}$$

$$20\% \quad \quad \quad = 80 \text{ minutes allowance}$$

Total	480 minutes
-------	-------------

As per second formula, a worker should produce in 480 minutes $\div 2:50 = 192$ units per day.

$$192 \text{ units} \times 2 = 384 \text{ minutes working time}$$

$$\text{Balance} \quad \quad \quad 96 \text{ minutes for allowance}$$

Total	480 minutes
-------	-------------

(b) For theory portion, please refer to *Advanced Cost Accounting (now titled Advanced Cost and Management Accounting—Text)* by Saxena & Vashist.

Time Study Observation

Problem 16.9. For a certain element of work, the basic time is established to be 20 seconds. If for three observations, a time study observer records rating of 100, 125 and so on a '100 normal scale' what is the observed timings. (I.C.W.A. Inter R.S., June 1985)

$$\text{Solution. Normalised Time} = \text{Time taken} \times \text{Rating} \%$$

$$\text{Basic Time} = \text{Observed time} \times \text{Rating} \%$$

(a) If Rating is 100 :

$$20 \text{ seconds} = \text{Observed time} \times 100\%$$

$$\text{Observed time} = 20 \text{ seconds}$$

(b) If rating is 125

$$20 \text{ seconds} = \text{Observed time} \times 125\%$$

$$\text{Observed time} = 20 \div 1.25 \text{ or } 16 \text{ seconds}$$

(c) If rating is 80

$$20 \text{ seconds} = \text{Observed time} \times \frac{80}{100}$$

$$\text{Observed time} = 20 \div 0.8 = 25 \text{ seconds.}$$

Incentive scheme and net labour productivity

Problem 16.10. An incentive scheme allows proportionate production bonus beyond 100% performance level. Calculate the amount of (i) incentive bonus and (ii) total payment received by an operator on a particular day during which the following particulars apply :—

Operation	: Assembling pocket transistor radio set
Work content	: 30 standard minutes per assembled set
Attended time	: 8 hours
Time spent on unmeasured work	: 2 hours

Number of sets assembled during the day : 15

Wage rate : Rs. 4/- per hour

(iii) What is the net labour productivity achieved by the Operator during the day ? (I.C.W.A. Inter, Dec. 1985 R.S.)

Solution :

(i) Amount of Incentive Bonus

Standard hours required for assembling 15 sets = $\frac{30 \times 15}{60} = 7.5$

Time spent on measured work (8-2)=6 hours

Performance level = $(7.5 \text{ hrs.} \div 6 \text{ hrs.}) \times 100 = 125\%$

Entitlement level = $125 - 100 = 25\%$

Incentive Bonus = (Hours of measured work \times wage rate) $\times 25\%$
 $= (6 \text{ hrs} \times \text{Rs. } 4) \times 25\% = \text{Rs. } 6$

Wages for 8 hours @ Rs. 4 per hour Rs. 32

(ii) Total payment Rs. 38

(iii) Net labour productivity = Output \div Hours of measurable work.
 $= 15 \div 6 = 2.5$ sets per hour.

Problem 16-11 (Miscellaneous) Manufacture of a component requires operations to be performed on three machines P, Q and R respectively, the standard time and operator efficiencies being as follows,—

Machines	Standard hours per component	Operator efficiency
P	0.16	80%
Q	0.23	100%
R	0.09	90%

If the factory operates 2 shifts of 8 hours each and the machines are available for production throughout the shifts on six days in a week, how many of machines P, Q and R will be required to produce 4,800 components per week ?

How many hours of capacity, if any, would be available from the machines P, Q or R for doing other jobbing work ?

(I.C.W.A. Inter December, 1987)

Solution : Available hours per machine = 6 days \times 2 shifts \times 8 hours
 $= 96$ hours

Machine	Std. hours per component	Operator Efficiency	Actual hours per component	Output (units)	Actual Hrs.
P	0.16	80%	0.20	4,800	960
Q	0.23	100%	0.23	4,800	1,104
R	0.09	90%	0.10	4,800	480

	<i>P</i>	<i>Q</i>	<i>R</i>
(a) Actual hours for 4800 components	960	1104	480
(b) Available hours per machine	96	96	96
(c) No. of Machines required ($a \div b$)	10	11.5	5
		or 12	

Machines *P* and *R* will be fully utilized. However, machine *Q* will have a spare capacity of $\frac{1}{2}$ machine, i.e., $\frac{1}{2} \times 96 = 48$ hours per week.

Overall labour productivity

Problem 16.12. The following data is available for a manufacturing unit ;

No. of operators	:	15
Daily working hours	:	8
No. of days per month	:	25
Std. Production per month	:	300 units
Std. Labour hours per unit.	:	8
The following information were obtained for November 1985 :—		
Mandays lost due to absenteeism	:	20
Units produced	:	240
Idle Time	:	276 man hours

Find the following :

- Per cent absenteeism
- Efficiency of utilisation of labour
- Productive efficiency of labour
- Overall productivity of labour in terms of units produced per man per month. (*I.C.W.A. Inter, Dec. 1980; Dec. 1987 Similar*)

Solution : (i) Per cent absenteeism = $(\text{No. of employees absent per day} \div \text{No. of operators}) \times 100$

No. of employees absent per day = $\text{Mandays lost due to absenteeism} \div \text{No. of days per month} = 30 \text{ Mandays} \div 25 \text{ days} = 1.2 \text{ Mandays}$

Per cent absenteeism $(1.2 \div 15 \text{ operators}) \times 100$ or 8%

(ii) Efficiency of utilisation of labour

Total man-hours $(15 \text{ operators} \times 8 \text{ hours} \times 25 \text{ days}) = 3,000$

Less : absenteeism $(30 \text{ mandays} \times 8 \text{ hours.})$ 240

Total man-hours available 2,760

Efficiency of utilisation of labour = $\frac{\text{Man-hours actually worked on production}}{\text{Total man-hours available}} \times 100$
 $= 2484 \div 2760 \times 100$ or 90%

(iii) Production Efficiency of labour

$$= \frac{\text{Std. Man-hours for actual production}^*}{\text{Man-hours actually worked in production}} \times 100$$

$$= 1920 \div 2484 \times 100 \text{ or } 77.29\%$$

*Std. man-hours for actual production

$$= \text{Units produced} \times \text{Std. labour hr. per unit}$$

$$= 240 \times 8 = 1920 \text{ Std. man-hours.}$$

(iv) Overall productivity of labour in terms of units produced per man per month.

$$= \frac{\text{Units produced} \times \text{No. of days per man month}}{\text{Actual man days}}$$

$$\frac{240 \text{ units} \times 25}{345^*} \text{ man-month or } 17.39 \text{ units per man-month.}$$

$$\text{*No. of mandays} = 15 \text{ operators} \times 25 \text{ days or } 375$$

$$\text{Mandays lost due to absenteeism } 30$$

$$345$$

Machine Productivity (Capacity Utilisation)

Problem 16.13. The following data is available for a machine in a manufacturing unit :

Hours worked per day	8
Working days per month	25
No. of Operator	1
Std. minutes per unit of production	
Machine time	22
Operator time	8
Total per unit	30

(i) If plant is operated at 75% efficiency, and the operator is working at 100% efficiency, what is the output per month?

(ii) If machine productivity is increased by 10% over the existing level, what will be the output per month?

(iii) If operator efficiency is reduced by 20% over the existing level, what will be the output per month?

(I.C.W.A. Inter, June 1986 RS)

Solution: (i) Working hours per month = 25 days \times 8 hrs. = 200 hrs.

30 minutes or $\frac{1}{2}$ hr is required for production = 1 unit

$$200 \text{ hrs are required for production} = \frac{2}{1} \times 1 \times 200$$

Output per month = 400 units

Plant standard minutes per unit of production = 22 hrs.

Plant efficiency	=75%
Plant standard minutes at 75% efficiency	=22 ÷ 75%
	or 29½ minutes
Operator's efficiency at 100%	8 minutes
	—
Total time per unit	37½ minutes
37½ minutes	=1 unit
200 hours	= $\frac{1}{37\frac{1}{2}} \times 60 \times 200$ or 321 units.

- (ii) Standard minutes per unit of production (Machine)=22 units
 Machine productivity increased by=10%
 Standard minutes per unit with increased productivity

$$= \frac{100}{110} \times 22 = 20 \text{ minutes}$$

Operator time = 8 minutes

Total time per unit 28 minutes

Output for 200 hours = $\frac{1}{28} \times 60 \times 200 = 428$ units

- (iii) Standard minutes per unit (operator)= 8 minutes
 Efficiency reduced by 20%=8 ÷ 80% or 10 minutes
 Machine time 22 minutes

Total time per unit 32 minutes

In 200 hrs output will be = $\frac{1}{32} \times 60 \times 200 = 375$ units

Cost effectiveness of two machines

Pr blem 16.14. Machines A and B are both capable of manufacturing a product. They compare as follows.

	<i>Machine A</i>	<i>Machine B</i>
Investment	Rs. 50,000	Rs. 80,000
Interest on capital invested.	15%	15%
Hourly charge (Wages+power etc.)	10	8
Pieces produced per hour	5	8
Annual operating hours	2,000	2,000

Which machine will give the lower cost per unit of output, if run for the whole year ?

If only 4,000 pieces are to be produced in a year, which machine would give the lower cost per piece ? (I.C.W.A. Inter, June 1986 RS)

Solution Statement showing cost per unit of two machines, if run for whole year.

	<u>Machine A</u>	<u>Machine B</u>
1. Capacity in Numbers (Annual operating hrs \times pieces produced per hr.)	10,000	16,000
2. Costs		
Interest on capital invested	Rs. 7,500	Rs. 12,000
Wages and power (operating hrs \times Hourly charges)		
Machine A $2,000 \times \text{Rs. } 10$	20,000	
Machine B $2,000 \times 8$		16,000
Total costs	27,500	28,000
Cost per unit ($2 \div 1$)	Rs. 2.75	Rs. 1.75

Machine B will give the lower cost per unit, if it runs for entire year.

If only 4,000 pieces to be produced in a year

	<u>Machine A</u>	<u>Machine B</u>
Pieces produced per hour	5	8
Hours required for 4,000 pieces	$4,000 \div 5 = 800$	$4,000 \div 8 = 500$
Interest on capital invested	Rs. 7,500	Rs. 12,000
Wages and power (800×10)	8,000	(500×8) 4,000
Total costs	15,500	16,000
Cost per unit	$15,500 \div 4,000$ = Rs. 3.875	$16,000 \div 4,000$ = Rs. 4.00

Machine A will give the lower cost.

Incentive bonus scheme

Problem 16.15. (a) Give three standard systems of incentive bonus to workers with brief explanation.

(b) An operator is paid a flat rate of Rs. 30 per day and Re. 1 per every additional 5 points of efficiency rating over a rating of 100 which represents standard performance, as incentive bonus.

The standard minutes per unit of production are 20 and the operator makes 27 units in a shift of $7\frac{1}{2}$ working hours.

(i) How much incentive bonus he would get per day ?

(ii) If the incentive system is modified to pay the incentive at the rate of 50% of the time saved, what incentive would he get ?

(I.C.W.A. Inter, Dec. 1966)

Solution. (a) Please refer to Advanced Cost Accounting (now titled Advanced Cost and Management Accounting—Text) by Saxena & Vashist.

(b) (i) As the operator is paid a flat rate of Rs. 30 per day and Re. 1 for every additional 5 points of efficiency rating of 100 (standard performance), it is necessary to find out the efficiency of the operator.

Operator's efficiency

$$= \frac{\text{Units produced} \times \text{Standard minutes per unit}}{\text{Actual time taken}} \times 100$$

$$= \frac{27 \text{ units} \times 20}{7.5 \text{ hrs.} \times 60} \times 100 = 120\%$$

5 points of efficiency rating of 100 = Re. 1

20 points of efficiency rating = $1/5 \times 20$ = Rs. 4

Incentive bonus = Rs. 4.

(ii) Time Saved = $540 - 450 = 90$ minutes or $1\frac{1}{2}$ hours

Hourly Rate = Flat rate (Rs. 30) \div Actual time ($7\frac{1}{2}$ hrs)
= Rs. 4 per hour

Bonus = 5% ($1\frac{1}{2}$ hrs \times Rs. 4) = Rs. 3

Cost effectiveness of two different tooling set-ups

Problem 16.16. Two alternate methods X and Y using different tooling set-ups may be employed to manufacture a component on a particular machine tool whose operating cost (including wages of operator) is Rs. 20 per hour :

	Method X	Method Y
Component	4,000 pieces	3,000 pieces
Cost of tooling	Rs. 320	Rs. 1500
Production rate per hour	10 pieces	15 pieces

Justify with suitable calculation which of the two methods would you choose as being more economical for regular production.

Would your answer be the same if only 1,000 pieces of the particular component are required? Give appropriate calculation to justify your answer.

(I.C.W.A. Inter, Dec. 1986)

Solution.

	Method X	Method Y
1. Tooling cost per piece		
	$320 \div 4,000 = \text{Re. } 0.08$	$1,500 \div 3,000 = \text{Rs. } 0.50$
2. Operating cost per hour	Rs. 20	Rs. 20
3. Production per hour	10 pieces	15 pieces
4. Operating cost per pieces ($2 \div 3$)	Rs. 2.00	Rs. 1.33
5. Total cost of production per piece	2.08	1.83

The total cost of production per piece is lower in Method Y. Therefore, Method Y should be chosen as being more economical for regular production.

Total cost for 1,000 pieces

	Method X	Method Y
Total operating cost		
	Rs. $2 \times 1,000 = \text{Rs. } 2,000$	$1.33 \times 1,000 = \text{Rs. } 1,330$
Add : Tooling cost (Fixed)	320	1,500
Total cost of production	<u>2,320</u>	<u>2,830</u>

Method X is more economical as its total cost is lower.

PPC (Production link incentive Scheme)

Problem. 16-17 (a) Mention the characteristics of a well designed production incentive scheme.

(b) An operator manufactures 11 identical components in a week of 48 work hours duration. Each component takes 360 standard minutes. Estimate the cost per component, if the company operates an incentive scheme as below :

Guaranteed basic rate is Rs. 4.00 per hour up to 80% performance level, 110% of the basic rate is paid if the performance level is between 80 to 100% and 120% of the rate is paid if the performance level falls between 101 to 110%. Above 110% performance level, 130% of the basic wages are paid. Materials component of each job is Rs. 20 and overhead component is 150% of the direct labour. (I.C.W.A. Inter June 1988)

Solution.

(a) Please refer to "Advanced Cost and Management Accounting—Text" by Saxena and Vashist.

(b) Each component takes 360 minutes or 6 hrs. as per standard

∴ No of jobs in 48 hours as per standard = $48 \div 6 = 8$ jobs

∴ Performance level = $(11 \text{ jobs} \div 8 \text{ jobs}) \times 100 = 137.5\%$

According to incentive scheme, the worker is to receive 130% of basic wages at this level of performance.

∴ Wages Rate = Rs. $4 \times 130\%$	=	Rs. 5.2 per hrs.
Labour Cost of job = 6×5.2	=	Rs. 31.20
Material Cost	=	20.00
Overhead (150% of D. Wages)	=	46.80
		<u>98.00</u>
		===

PPC (Production linked incentive scheme)

Problem. 16-18. Workmen of a certain grade are guaranteed a wage of Rs. 48 for an eight hour shift.

An incentive scheme is in operation which pays production hours directly proportional to production performance only after 100% level is reached. Four workmen P, Q, R, and S produce 90, 75, 60, and 48 units respectively in 6 hours. Work content of the job is 6 standard minutes per unit. Remaining 2 hours of the shift are spent on doing miscellaneous unmeasured work for which no incentive hours can be paid.

Find the total earnings per day for each workman.

Comment on the relative earnings of R and S.

(I.C.W.A. Inter June 1988)

Solution.

Workmen	P	Q	R	S
Units produced in 6 hours spent on measured work.	90	75	60	48
Standard Minutes produced at 6 standard Minutes Per unit (M)	540 <i>i.e.</i> 90×6	450 <i>i.e.</i> 75×6	360 <i>i.e.</i> 60×6	288 <i>i.e.</i> 48×6
Minutes worked in measured work in 6 hours (N)	360	360	360	360
Performance level $(M \div N) \times 100$	150% Rs.	125% Rs.	100% Rs.	80% Rs.
(A) Earnings on measured work for 6 hours	$36 \times 1.5^*$ =Rs. 54	$36 \times 1.25^*$ =Rs. 45	36×1 =Rs. 36	36×1 =Rs. 36
Guaranteed rate is Re. 6 per hour or Rs. 36.				
(B) Earnings on non-measured work of 2 hours @ Rs. 6 per hour	12	12	12	12
Total earnings for eight hours shift <i>i.e.</i> one day (A + B)	66	57	48	48

*Incentive scheme pays production hours directly proportionate to production performance after 100% level.

Comment's—Performance levels of *R* and *S* are not the same, but both of them earn Rs. 48 for an eight hour shift. This is the inherent disadvantage of "guaranteed base wage." There should be an arrangement, by which, if *S* does not improve his performance level, he should be considered for transfer to unmeasured work. While efficiency should be rewarded, inefficiency should be discouraged by system of remuneration.

Scanlon Plan.

Problem 16-19 (SQC) On making an estimate under preliminary observations a machine appears to be idle 40% of the total time available for its operation. Use a proper statistical formula to calculate how many observations should be made to obtain a more accurate estimate of idleness within limits of $\pm 10\%$ at 90% confidence level. (I.C.W.A. Inter, December 1987)

Solution. For 95% confidence level we have the statistical formula :

$$S. P. = \sqrt{\frac{P(1-P)}{N}} \quad \begin{array}{l} \text{where } N = \text{No. of observation required} \\ S = \text{Limits of error} \\ P = \text{Production of idle time expressed as a decimal.} \end{array}$$

Squaring both sides and transposing, we get

$$\begin{aligned} N &= \frac{4P(1-P)}{S^2 \cdot P^2} \\ &= \frac{4 \times 0.4(1-0.4)}{(0.1)^2 \times (0.4)^2} = \frac{4 \times 0.4(1-0.4)}{0.01 \times 0.16} \\ &= \frac{4 \times 0.4 \times 0.6}{0.0016} = 1000 \times 0.6 = 600 \text{ observations.} \end{aligned}$$

Estimating sample size for a population proportion.

$$\text{Here } p = 0.4, \quad q = 0.6$$

$$SE = \sqrt{\frac{pq}{n}}$$

Value of *Z* at 95% confidence level is 1.96.

$$\text{Error } E = 0.1.$$

$$\text{Now } E = Z(SE) = Z \sqrt{\frac{pq}{n}}$$

$$\therefore n = Z^2 \frac{pq}{E^2} = \frac{(1.96)^2 (0.4)^2 (0.6)^2}{(0.1)^2} = 22$$

Thus the sample size should be 22.

Problem. 16'20. A foundry firm wishes to instal enough automatic moulders to produce 2,50,000 good castings per year. The moulding operation takes 1.5 minutes per casting but its output is typically about 3 percent defective. How many moulders will be required if each one is available for 2,000 hours (of capacity) per year?

(I.C.W.A. Inter Dec. 1988)

Solution. The output turns out to be 3% defective, which means it is operating at 97% efficiency.

$$\text{Gross annual output} = 2,50,000 \div 0.97 = 2,57,732$$

$$\text{Individual moulding machine} = \text{Capacity per hour} = \frac{60 \text{ minutes}}{\div 1.5} = 40 \text{ units}$$

$$\text{Yearly production for 2,000 hrs.} = 2,000 \times 40 = 80,000 \text{ units}$$

$$\text{No. of machines required} = \frac{2,57,732}{80,000} = 3.22 \text{ machines}$$

As the number of machines cannot be in fraction, 3 machines should be used. The fractional work load can be completed by proper rescheduling, off the shift maintenance or overtime.

Problem 16 21. A company manufactures 200 units of a product everyday and sells it for Rs. 2 per unit and direct labour is paid Re. 1 per unit. Overheads are Rs. 800 per day in total. A market research survey indicates that 300 units can be sold per day if the price can be brought down to Rs. 7. Production can be increase to this level. if an incentive scheme which would cost Rs. 100 per day to admigister is implemented, giving the workmen proportionate increase in their earnings. Examine with appropriate calculations whether, and if so, how much gains are made by the company and the workmen. Comment on the social desirability of such incentive schemes. (I.C.W.A. Inter Dec., 1988)

Solution.	Per Unit
Direct material cost	Rs. 2
Labour Cost	1
Overhead Rs. 800 \div 200	4
	—
Total cost of sales	7
Selling Price	8
	—
Profit	1
	—
Total profit 200×1	200

With Proposed Incentive (output and sales 300 units)

	Per Unit
Direct material cost	Rs. 2
Direct labour cost	1
Overhead (Rs. 800 + Rs. 100) \div 300	3
	—

Total cost of sales	6
Selling Price	7
	—
Profit	1
	—
Total profit 300×1	300
	==

Total wages has gone up to Rs. 300 as against Rs. 200 without incentive. Suppose, labour strength is 5 workers with revised incentive wage per worker is Rs. 60 as compared to Rs. 40 per worker earlier. The customers will also be benefitted by Re. 1 per unit. Such a scheme is socially desirable since it leads to great economic wellbeing of the society as everybody is better off.

Problem 16-22. Machines *K* and *L*, both capable of manufacturing an industrial product compare as follows :

	<i>Machine K</i>	<i>Machine L</i>
Investment	Rs. 60,000/-	Rs. 1,00,000/-
Interest on borrowed capital	15%	15%
Operating cost (wages, power etc.) per hour	Rs. 12/-	Rs. 10%
Production per hour	6 pieces	10 pieces

The factory, whose overhead costs are Rs. 1,20,000 works effectively for 4000 hours in 2 shifts during the year.

- Justify with appropriate calculations which of the two machines you would choose for regular production.
- If only 4,000 pieces are to be produced in a year, which machine would give the lower cost per piece.
- For how many pieces of production per year would the cost of production be the same on either machine?

(For above comparisons, the cost of material may be excluded as being the same on both machines). (J.C.W.A. Inter Dec., 1988)

Solution. (i)	<i>Machine K</i>	<i>Machine L</i>
(a) Interest on borrowed capital @ 15%	Rs. 9,000	Rs. 15,000
(b) Annual operating charges for 4,000 hours	48,000	40,000
(c) Factory Overheads	1,20,000	1,20,000
	<hr/>	<hr/>
1. Total annual cost	1,77,000	1,75,000
	<hr/>	<hr/>
2. Yearly Production $6 \times 4,000$ $10 \times 4,000$	24,000	40,000
3. Cost per piece ($1 \div 2$)	Rs. 7.38	Rs. 4.38

Machine *L* should be used for regular production as its cost per unit is substantially lower than Machine *K*.

(ii) For producing only 4,000 piece p.a.

	<i>Machine K</i>	<i>Machine L</i>
Hours required for producing 4,000 pieces	$4,000/6$	$4,000/10$
Operating charges	Rs. $12 \times 4,000/6$ = Rs. 8,000	$10 \times 4,000$ Rs. 4,000
Add. interest and overhead (a + c)	1,29,000	1,35,000
Total Cost	<u>1,37,000</u>	<u>1,39,000</u>
Cost per piece	Rs. 34.25	Rs. 34.75

Machine K should be preferred.

(iii) Let at x production, the cost of production of both the machines will be the same. By substituting the value 4,000 for x in (ii) above.

$$12 \times x/6 + 1,29,000 = 10 \times x/10 + 1,35,000$$

$$2x - x = 6,000 \quad \text{or} \quad x = 6,000 \text{ pieces}$$

Contents of Appendix A

		<i>Problem Numbers</i>
1.	Materials	
	Inventory Levels	A 61, 74, 105
	Valuation of Material Issues/Stock	A 71, 88, 112, 165
	Discrepancies in Stock-taking	A 241
2.	Labour	
	Remuneration and Incentives	A 25, 76, 113, 152, 162, 200, 242, 243
	Miscellaneous	A 38, 42, 57
3.	Overheads	
	Departmentalisation	A 5, 89
	Computation of O.H. rate	A 18 28, 39, 40, 58, 59, 164, 193
	Miscellaneous	A 77, 106, 166
4.	Cost Book-keeping	
	Control Accounts	A 4, 26, 67, 189, 266,
	Reconciliation	A 151, 159, 247
	Shortages & Discrepancies	A 245
5.	Job Costing	
	Cost Sheet/Unit Costing	A 9, 41, 103, 167, 201, 205, 218, 251
	Contract Costing	A 63, 160, 188, 192
	Job Costing	A 78
	Activity Based Costing	A 236
6.	Process Costing	
	Average Method	A 209
	Equivalent Production	A 47, 148, 168, 244, 246, 249
	Normal and Abnormal Loss	A 91, 118, 134, 202, 227, 240
	Inter Process Profit	A 194
7.	Operating Costing	
	Transport Costing	A 70, 74, 239, 248
8.	Joint Products and By-Products	
	Apportionment	A 7, 48, 80, 114, 135, 150, 173, 238
	Miscellaneous	A 75
	Further Processing (Eqv. Concept)	A 214, 230
9.	Marginal Costing	
	B.E. Analysis	A 13, 21, 22, 27, 30, 43, 69, 82, A 102, 115, 119, 123, 137, 197, 204, A 210, 250, 255
	B.E. Chart	A 190, 967
	Key Factor	A 51, 83, 65, 84, 109, 129, 175, A 258
	Change in Cost, Volume and Price	A 2, 6, 8, 73, 170, 54, 203
	Production Mix	A 108, 126, 133, 149, 220, 254
	Merging the two Plants	
	Marginal Costing vs. Absorption Costing	A 15, 92, 116, 124, 157, 195, 213, A 229

10. Decision Making	
Make or Buy Decision	A 12, 45, 50, 95, 107, 163, 184, A 198
Accepting/Quoting for an Order/ Contract	A 10, 15, 35, 49, 252
Export Order	A 36, 53, 56, 161
Production Decision	A 3, 110, 176, 180
Marketing Decision	A 20, 31, 125, 147
Choice of Best Alternative	A 19, 32, 33, 101, 136, 256
Investment Decision	A 66, 87, 98, 100, 144, 216, 222, A 234, 259, 265, 270, 272
Cost Indifference Point	A 121, 224
Value Added	A 38, 132
Manufacture vs. Sub-contract	A 181, 215
11. Budgetary Control	
Flexible Budget	A 44, 117, 169, 171, 199
Functional Budget	A 1, 29, 85, 140, 211, 226, 237, A 261
Programme Budgeting	A 37
Responsibility Accounting	A 154, 177, 212
12. Standard Costing	
Material Variance	A 60, 68, 81, 172
Labour Variance	A 196, 231
Fixed Overhead Variance	A 104, 142, 206
Operating Statement (Recon- ciliation)	A 93, 111, 122, 153, 219
Miscellaneous	A 11, 16, 17, 24, 34, 46, 62, 64, 72, A 79, 86, 90, 111, 191, 255, 260, 267, A 273
Variance Control A/c	A 254
Non-conventional Variance Analysis	A 182, 262,
13. Pricing	
Rate of Return Pricing	A 178, A 207, 233, 235
Transfer Pricing	A 99, 145, 179, 217
Miscellaneous	A 97, 130, 156, 208, 271
Shadow Pricing	A 186
14. Inflation Accounting	A 187, 225, 226
15. Mathematical/Statistical Application	A 94, 96, 127, 128, 131, 139, 141, A 143, 232, 146, 155, 183, 221, 223, A 232, 263, 264, 268, 269

Appendix I
Problems from Recent Examinations
C.I.M.A London November, 1987

For question on Marginal Costing—Limiting Factor ; please refer to Problem 9 28 on page P 9 49.

Cash Budget

Problem 1. A redundant manager who received compensation of Rs. 80,000 decides to commence business on 4th January, 1988, manufacturing a product for which he knows there is a ready market. He intends to employ some of his former workers who were also made redundant but they will not all commence on 4th January. Suitable premises have been found to rent and second-hand machinery costing Rs. 60,000 has been bought for Rs. 80,000. This machinery has an estimated life of five years from January 1988 and no residual value.

Other data

1. Production will begin on 4th January and 25% of the following month's sales will be manufactured in January. Each month thereafter the production will consist of 75% of the current month's sales and 25% of the following month's sales.

2. Estimated sales are :

	Units	Rs.
January	Nil	Nil
February	3,200	80,000
March	3,600	90,000
April	4,000	1,00,000
May	4,000	1,00,000

3. Variable production cost per unit

Direct materials	Rs. 7
Direct wages	6
Variable overhead	2
	<hr/>
	15
	<hr/>

4. Raw material stocks costing Rs. 10,000 have been purchased (out of the manager's Rs. 80,000) to enable production to commence and it is intended to buy, each month, 50% of the materials required for the following month's production requirements. The other 50% will be purchased in the month of production. Payment will be made 30 days after purchase.

5. Direct workers have agreed to have their wages paid into bank accounts on the seventh working day of each month in respect of the previous month's earnings.

6. Variable production overhead : 60% is to be paid in the month following the month it was incurred and 40% is to be paid one month later.

7. Fixed overheads are Rs. 4,000 per month. One quarter of this is paid in the month incurred, one-half in the following month, and the remainder represents depreciation on the second-hand machinery.

8. Amounts receivable : a 5% cash discount is allowed for payment in the current month and 20% of each month's sales qualify for this discount. 50% of each month's sales are received in the following month, 20% in the third month and 8% in the fourth month. The balance of 2% represents anticipated bad debts.

You are required to : (i) Prepare a cash budget for each of the first four months of 1988, assuming that overdraft facilities will be available.

(ii) State the amount receivable from customers in May.

Solution. (i) Cash Budget for the first four months

	January	February	March	April
Balance b/d	Rs. 10,000	Rs. 9,000	Rs. 3,890	Rs. 9,090
Sales (Note 1)	Nil	15,200	57,100	80,000
	10,000	24,200	60,990	89,090
Purchases (Note 3)		11,500	24,500	26,950
Wages (Note 4)		4,800	19,800	22,200
Variable overhead (Note 5)		960	4,600	7,080
Fixed overhead (Note 6)	1,000	3,000	3,000	3,000
	1000	20,310	51,900	59,230
Balance c/d	9,000	3,890	9,090	29,860
	=====	=====	=====	=====

Notes. 1. Sales (Rs.)

	Amount	20% Discount 5%	Net	50%	20%	8%	Total Cash Receipts
Jan.	—	—	—	—	—	—	—
Feb.	80,000	16,000	800	15,200	—	—	15,200
March	90,000	18,000	900	17,100	40,000	—	57,100
April	1,00,000	20,000	1,000	19,000	45,000	16,000	80,000
May	1,00,000	20,000	1,000	19,000	50,000	18,000	6,400
							93,400

2. Production (units)

					Total
Jan.	800				
Feb.	2,400	900			3,300
March		2,700	1,000		3,700
April			3,000	1,000	4,000
May				3,000	
	<u>3,200</u>	<u>3,600</u>	<u>4,000</u>	<u>4,000</u>	

3. Purchases

		50%	Total	Per unit (Rs.)	Amount (Rs.)
Jan.	3,300 in Feb.	1,650	1,650	7	11,550
Feb.	3,700 in March	1,850	3,500	7	24,500
March	4,000 in April	2,000	3,850	7	26,950

4. Direct Wages

Month	Production	Wage Rate (Rs.)	Amount (Rs.)	Paid in
Jan.	800	6	4,800	February
Feb.	3,300	6	19,800	March
March	3,700	6	22,200	April
April	4,000	6	24,000	May

5. Variable Overhead

				Paid in			
	Pro- duction	V.O. Rate (Rs.)	Amount (Rs.)	Feb.	March	April	May
Jan.	800	2	1,600	960	640		
Feb.	3,300	2	6,600		3,960	2,640	
March	3,700	2	7,400			4,440	2,960
April	4,000	2	8,000				
				<u>960</u>	<u>4,600</u>	<u>7,080</u>	<u>2,960</u>

6. Fixed Overhead

	Rs.	Jan.	Feb.	March	April
Jan.	3,000	1,000	2,000		
Feb.	3,000		1,000	2,000	
March	3,000			1,000	2,000
April	3,000				1,000
		<u>1,000</u>	<u>3,000</u>	<u>3,000</u>	<u>3,000</u>

(ii) Amount receivable from customers in May = Rs. 93,400

Product Mix

***Problem 2.** A South Indian farms 960 hectares of land on which he grows squash, kale, lettuce and beans. Of the total, 680 hectares are suitable for all four vegetables, but the remaining 280 hectares are suitable only for kale and lettuce. Labour for all kinds of farm work is plentiful.

The market requires that all four types of vegetable must be produced with a minimum of 10,000 boxes of any one line. The farmer has decided that the area devoted to any crop should be in terms of complete hectares and not in fractions of a hectare. The only other limitation is that not more than 2,27,500 boxes of any one crop should be produced.

Data concerning production, market prices and costs are as follows :

	<i>Squash</i>	<i>Kale</i>	<i>Lettuce</i>	<i>Beans</i>
Annual yield				
(boxes per hectare)	350	100	70	180
Costs				
Direct :	Rs.	Rs.	Rs.	Rs.
Materials per hectare	476	216	192	312
Labour :				
Growing, per hectare	896	608	372	528*
Harvesting and packing,				
per box	3.60	3.28	4.40	5.20
Transport, per box	5.20	5.20	4.00	9.60
Market price, per box	15.38	15.87	18.38	22.27
Fixed overheads per annum :				
Growing		Rs. 1,22,000		
Harvesting		74,000		
Transport		74,000		
General administration		1,00,000		
Notional rent		74,000		

It is possible to make the entire farm viable for all four vegetables if certain drainage work is undertaken. This would involve capital investment and it would have the following effect on direct harvesting costs of some of the vegetables :

	<i>Capital cost</i>	<i>Change from normal harvesting costs</i>	
	<i>Rs.</i>	<i>Squash</i>	<i>Beans</i>
		<i>(Rs. per box)</i>	
First lot of 10 hectares	19,000 total	+1.2	-1.2
Next lot of 10 hectares	17,500 total	+1.3	-1.3
Next lot of 10 hectares	15,000 total	+1.4	-1.4
Remaining land			
(per hectare)	1,850	+1.5	-1.5

The farmer is willing to undertake such investment only if he can obtain a return of 15% DCF for a four-year period.

You are required to advise the farmer, with the given constraints :

- (i) the area to be cultivated with each crop if he is to achieve the largest total profit,
- (ii) the amount of this total profit,
- (iii) the number of hectares it is worth draining and the use to which they would be put.

Note. Show all relevant calculations in arriving at your answer. Ignore tax and inflation.

Solution. (i) and (ii) Please refer to the approach in Problem 9.2 on page P9.3.

Ans. (i) Squash—624, Kale—100, Lettuce—180, Beans—56.

(ii) Total profit Rs. 1,80,929.60.

(iii) **Drainage investment worth undertaking**

At present, lettuce are grown in excess of the minimum of 10,000 boxes when additional, higher-contribution squash or beans could be produced.

Present planting for lettuce	12,600 boxes = 180 hectares
Minimum of 10,000 boxes	= 143 hectares (10,010 boxes)
Excess	<u>37 hectares</u>

Squash could be grown for an additional 2,17,500 = 2,18,400 boxes = 9,100 boxes at 350 boxes to a hectare = 26 hectares, leaving for additional beans 37 - 26 = 11 hectares.

11 hectares produces 11×180 boxes = 1,980 boxes and is still within maximum. Alternatively, all 37 hectares could be used for beans, to produce $37 \times 180 = 6,660$ boxes and still be within the maximum.

Calculation of new contributions (Rs.)

<i>Squash</i>		<i>Beans</i>	
At present	931.0	At present	504.6
1st 10 hectares— $1.2 \times 350 = 420$	511.0	+ $1.2 \times 180 = 216$	720.6
2nd 10 hectares— $1.3 \times 350 = 455$	476.0	+ $1.3 \times 180 = 234$	738.6
3rd 10 hectares— $1.4 \times 350 = 490$	441.0	+ $1.4 \times 180 = 252$	756.6
4th 7 hectares— $1.5 \times 350 = 525$	406.0	+ $1.5 \times 180 = 270$	774.6

Therefore, it would be more favourable to use all 37 hectares to substitute beans for lettuce.

Additional contributions (Rs.)

<i>Hectares</i>	<i>Beans</i>	<i>Lettuce</i>	<i>Excess per hectare</i>	<i>Total excess</i>
1st 10	720·6	134·6	586·0	5,860
2nd 10	738·6	134·6	604·0	6,040
3rd 10	756·6	134·6	622·0	6,220
4th 7	774·6	134·6	640·0	4,480

Investment calculation of 15% Discounted Cash Flow (DCF) for four years (in Rs.)

<i>Extra drainage</i>	<i>DCF Cumulative factor</i>	<i>Present value (PV)</i>	<i>Investment needed</i>	<i>PV difference</i>	<i>PV Cumulative difference</i>
1st 5,860	2·86	16,760	19,000	(2,240)	(2,240)
2nd 6,040	2·86	17,274	17,500	(226)	(2,466)
3rd 6,220	2·86	17,789	15,000	2,789	323
4th 4,480	2·86	12,813	12,950	(137)	186

There is a financial advantage to invest for drainage of 30 hectares of land to grow beans instead of lettuce.

Drain 30 hectares only for growing beans**Problem 3: Production Decision (Closure of a Department)**

You have been asked to evaluate the performance of a departmental store in a retail group. The quality of the store's merchandise is fairly high and its image with its clientele is largely based on the interdependence of the merchandise in its different departments.

The four departments are Garden Equipment (GE); Dining Furniture (DF); DIY Decorating Products (DIY); Crockery and Glassware (CG).

The following data have been prepared by the store accountant for the year ended 31st October, 1987 :

	<i>Basis of apportion- ment</i>	<i>GE Rs. '000</i>	<i>DF Rs. '000</i>	<i>DIY Rs. '000</i>	<i>CG Rs. '000</i>	<i>Total Rs. '000</i>
Sales	Actual	1,240	900	600	560	3,300
Gross margin	Actual	440	450	200	280	1,370
Direct costs :						
Supervision	Actual	15	20	20	25	80
Sales staff	Actual	135	216	81	108	540
Advertising	Actual	12	6	8	14	40
		162	242	109	147	660
Gross contribution		278	208	91	133	710

Costs apportioned :

Rent and rates	Floor space at Rs. 4 sq. ft.	30	48	18	24	120
Heat and light	Weighted floor space	10	12	3	10	35
		<hr/> 40	<hr/> 60	<hr/> 21	<hr/> 34	<hr/> 155
Net contribution		238	148	70	99	555
Other overhead	Sales	83	60	40	37	220
Net profit before tax		<hr/> 155	<hr/> 88	<hr/> 30	<hr/> 62	<hr/> 335

A new managing director with retailing experience has been appointed from outside the group. He has said that he considers that a department should achieve a net profit before tax of at least 7.5% on sales and that he is prepared to close any department not meeting that criterion.

You are required to:

(a) (i) work out various ratios based on above information and identify which departments, if any, qualify for closure under this criterion;

(ii) state whether or not you would recommend their closure, explaining the reasons for your recommendations;

(b) recommend briefly what changes management might consider to improve the store's total profitability.

Solution.**Workings.**

		<i>Departments</i>				<i>Total</i>
		<i>GE</i>	<i>DF</i>	<i>DIY</i>	<i>CG</i>	
Net profit/sales	%	12.5	9.8	5.0	11.1	10.2
Gross margin/sales	%	35.5	50	33.3	50.0	41.5
Gross margin per sq. ft.	Rs.	58.70	37.50	44.40	46.70	45.70
Sales per sq. ft.	Rs.	165.30	75.00	133.30	93.30	110.00
Gross contribution/ sales	%	22.4	23.1	15.2	23.7	21.5
Gross contribution per sq. ft.	Rs.	37.10	17.30	20.20	20.20	23.70
Net contribution/ sales	%	19.2	16.4	11.7	17.7	16.8
Net contribution per sq. ft.	Rs.	31.70	12.30	15.60	16.50	18.50

(a) (i) Department DIY qualifies for closure under the new criterion.

(ii) One should not recommend the closure of department DIY.

There are three major reasons for this, two of which are technical, management accounting reasons and the third a strictly commercial one.

The management accounting reasons are :

*There is considerable doubt as to the validity of the net profit figure for DIY (and the others, too). This is because it is arrived at after the deduction of apportioned costs. Whilst the basis of apportioning rent and rates on square footage may be easily acceptable, that used for 'other overheads'—representing such costs as general management salaries, clerical and administration costs, transport, portage, etc.—in no way reflects each department's relative usage of the services provided by those costs. Even the use of square footage as a basis for rent and rates ignores the possibility that, if the building is on more than one floor, the ground floor may be deemed to cost more than the upper floors if rented out separately. To use a questionable net profit figure as a basis of decision as to closure of a department is thus very dangerous.

*This position is made even worse by the fact that many of the apportioned costs may be fixed in total for the year. In this case, closure of the department will not eliminate them and may not even reduce them. All that closure would do is to eliminate the contribution, certainly at the gross level, without reducing any part of those costs that are fixed (e.g., such items as top management salaries, rent and rates, etc.).

As a generalisation, as long as a department is making a contribution to profit, there is no justification *per se* to close it. In this particular case, the statistical data at (a) (i) above shows that department DIY compares favourably with other departments for sales per square foot (an important index in view of the space limitations of the store) and at the gross margin, gross contribution and net contribution per square foot levels it is superior throughout to Department DF.

The commercial reason for advising against closure is that the narrative in the question draws attention to high image amongst the store's clientele arising from the interdependence of the merchandise in its different departments. To close a department in such a situation is likely to reduce the customer throughput in the store to the detriment of the remaining departments. Taken together with the technical objections, the case against closure seems very strong.

(b) Recommended changes :

According to economic theory, one should aim to equate the marginal revenue per department. This would involve :

*The allocation of more space to GE from the other departments, especially from DF. Thus, if sales per square foot were maintained, movement of space to GE would yield an extra :

Rs. 21'20 per sq. ft. from DF	(Rs. 58'70—Rs. 37'50)
Rs. 14'30 per sq. ft. from DIY	(Rs. 58'70—Rs. 44'40)
Rs. 12 per sq. ft. from CG	(Rs. 53'70—Rs. 46'70)

DF would need to consider its revised display/layout/range if it were to yield up space to GE. It is possible also that such a move might result in a reduction in stock in DF, an increase in stock turnover and a resultant reduction in interest charges.

Note. The converse might result for GE, but higher margins should amply offset this and there is the possibility that a stock increase in GE might be less than the reduction of stock in DF.

*The elasticity of demand for the departments' products should be examined. The possibilities of a reduction in DF's or DIY's prices leading to a disproportionately large increase in their sales should be examined. Conversely, an increase in their prices or in those of GE should be considered.

*The possibility of taking advantage of the apparent counter-seasonality of GE and DIY (or DF) should be examined. It may be possible to increase and decrease the space in each alternately by season.

*It may be possible to link the merchandise of the different departments through some promotional activity, e.g., linking special DIY items with GE in summer

C.A. Inter, May 1988

Cost Book-keeping (Cost Control Accounts)

Problem 4. In the absence of the Chief Accountant, you have been asked to prepare a month's cost accounts for a company which operates a batch costing system fully integrated with the financial accounts. The following relevant information is provided to you :

<i>Balances at the beginning of the month</i>	Rs.
Stores Ledger Control Account	25,000
Work in Progress Control Account	20,000
Finished Goods Control Account	35,000
Prepaid Production Overheads brought forward from previous month	3,000
<i>Transactions during the month :</i>	
Materials Purchased	75,000
Materials Issued :	Rs.
To Production	30,000
To Factory Maintenance	4,000
	<hr/>
	34,000
Materials transferred between batches	5,000

Total wages paid :	Rs.	
To Direct workers	25,000	
To Indirect workers	5,000	
	<hr/>	30,000
Direct wages charged to batches		20,000
Recorded non-productive time of direct workers		5,000
Selling and Distribution overheads incurred		6,000
Other Production overheads incurred		12,000
Sales		1,00,000
Cost of Finished Goods Sold		80,000
Cost of Goods completed and transferred into finished goods during the month		65,000
Physical value of work-in-progress at the end of the month		40,000

The production overhead absorption rate is 150% of direct wages charged to work-in-progress.

Required :

Prepare the following accounts for the month :

- Stores Ledger Control Account ;
- Work-in-progress Control Account ,
- Finished Goods Control Account ;
- Production Overhead Control Account ; and
- Profit and Loss Account.

Solution.

(a) **Stores Ledger Control Account**

To Balance b/d	Rs. 25,000	By W.I.P. A/c	Rs. 30,000
„ Creditors	75,000	„ Production Overhead Control A/c	4,000
		„ Balance c/d	66,000
	<hr/>		<hr/>
	1,00,000		1,00,000

(b) **Work-in-progress Control Account**

To Balance b/d	Rs. 20,000	By Finished Goods A/c	Rs. 65,000
„ Stores L.C. A/c	30,000	„ Balance c/d	40,000
„ Wages Control A/c	20,000		
„ Productive O.H. A/c	30,000		
„ Profit and Loss A/c*	5,000		
	<hr/>		<hr/>
	1,05,000		1,05,000

* Balancing figure is abnormal gain to be credited to P & L A/c.

(c) Finished Goods Control Account

To Balance b/d	Rs. 35,000	By Cost of Sales A/c	Rs. 80,000
„ W.I.P. A/c	65,000	„ Balance b/d	20,000
	<u>1,00,000</u>		<u>1,00,000</u>
	=====		=====

Cost of Sales A/c

To Selling & Dist. O.H. A/c	Rs. 6,000	By P & L A/c	Rs. 86,000
„ F.G. Control A/c	80,000		
	<u>86,000</u>		<u>86,000</u>
	=====		=====

(d) Production Overhead Control Account

To Balance b/d	Rs. 3,000	By W.I.P. A/c	Rs. 30,000
„ Stores L.C. A/c	4,000		
„ Wages Control A/c			
Direct workers	Rs. 5,000		
Indirect workers	Rs. 5,000		
	<u>10,000</u>		
„ Bank	12,000		
„ P & L A/c (overabsorption)	1,000		
	<u>30,000</u>		<u>30,000</u>
	=====		=====

(e) Profit & Loss Account

To Cost of Sales A/c	Rs. 86,000	By Sales A/c	Rs. 1,00,000
„ Balance c/d	20,000	„ W.I.P. A/c (Abnormal gain)	5,000
		„ Production O.H. Control A/c	1,000
	<u>1,06,000</u>		<u>1,06,000</u>
	=====		=====

Notes. (i) Intra-batch transfer of materials will not affect Control A/c.

(ii) Non-production time of direct workers is production overhead.

- (iii) Production Overhead incurred is Rs. 30,000, i.e., 150% of Direct Wages of Rs. 20,000.
- (iv) Opening and Closing W.I.P. balances are given and balancing figure given is treated as abnormal gain, which should be looked into. Since it is not ordinary item of cost, it has been credited to P & L A/c.

For question on Remuneration and Incentive—Rowan Scheme, please refer to Problem 2·10 on page 2·13.

Computation of Overhead Rates (Step Ladder Method)

Problem 5. Deccan Manufacturing Ltd. have three departments which are regarded as production departments. Service departments' costs are distributed to these production departments using the "Step Ladder Method" of distribution. Estimates of factory overhead costs to be incurred by each department in the forthcoming year are as follows. Data required for distribution is also shown against each department :

Department	Factory Overhead (Rs.)	Direct Labour Hours	No. of Employees	Area in sq. mt.
Production :				
X	1,93,000	4,000	100	3,000
Y	64,000	3,000	125	1,500
Z	83,000	4,000	85	1,500
Service :				
P	45,000	1,000	10	500
Q	75,000	5,000	50	1,500
R	1,05,000	6,000	40	1,000
S	30,000	3,000	50	1,000

The overhead costs of the four service departments are distributed in the same order, viz., P, Q, R and S respectively on the following basis :

Department	Basis
P	—
Q	—
R	—
S	—

You are required to :

- (a) prepare a schedule showing the distribution of overhead costs of the four service departments to the three production departments ; and
- (b) calculate the overhead recovery rate per direct labour hour for each of the three production departments.

Solution.**Deccan Manufacturing Ltd.**

(a) Schedule showing the distribution of overhead costs of the four service departments.

	Service				Production			
	P	Q	R	S	X	Y	Z	
Overhead	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Distribution of Overhead of:	45,000	75,000	1,05,000	30,000	1,93,000	64,000	83,000	
Deptt. P	(45,000)	5,000	4,000	5,000	10,000	12,500	8,500	
Deptt. Q		(80,000)	24,000	12,000	16,000	12,000	16,000	
Deptt. R			(1,33,000)	19,000	57,000	28,500	28,500	
Deptt. S				(66,000)	24,000	18,000	24,000	
Total (i)					3,00,000	1,35,000	1,60,000	
Direct Labour Hours (ii)					4,000	3,000	4,000	
(b) Overhead recovery rate (i) ÷ (ii)					Rs. 75	Rs. 45	Rs. 40	

Product Mix and Overall B.E. Sales

Problem 6. Taurus Ltd. produces three products—A, B and C, from the same manufacturing facilities. The cost and other details of the three products are as follows :

	A	B	C
Selling price/unit (Rs.)	200	160	100
Variable cost/unit (Rs.)	120	120	40
Fixed expenses/month (Rs.)			2,76,000
Maximum production per month (units)	5,000	8,000	6,000
Total hours available for the month			200 hours
Maximum demand per month (units)	2,000	4,000	2,400

The processing hours cannot be increased beyond 200 hours per month.

You are required to :

- compute the most profitable product-mix ;
- compute the overall break-even sales of the company for the month based on the mix calculated in (a) above.

Solution. Working Notes :

Product	A	B	C
	Rs.	Rs.	Rs.
Selling Price per unit	200	160	100
Variable Cost per unit	120	120	40
Contribution per unit (a)	80	40	60
	==	==	==
Maximum production per hour in units (b)	25	40	30
	<i>i.e., 5000/200</i>	<i>i.e., 8000/200</i>	<i>i.e., 6,000/200</i>
Contribution per hour			
(a × b)	Rs. 2,000	Rs. 1,600	Rs. 1,800
Ranking	I	III	II

Units to be produced keeping demand in view :

- First maximum no. of A should be produced, *i.e.*, 2,000 units, which will utilise 80 hrs., *i.e.*, $2000 \div 25$ leaving a balance of 120 hrs., *i.e.*, 200 hrs—80 hrs yet to be utilized.
- Maximum no. of C should be produced, *i.e.*, 2,400 units, which will utilize 80 hrs., *i.e.*, $2,400 \div 30$ leaving a balance of 40 hrs still to be used.

- (iii) These 40 hrs. should be used for production of *B* and in this period, 600 units of *C*, i.e., 40×40 will be produced.

(a) **Optimum product mix and its contribution :**

	Units		Contribution per unit		Total Contri- bution
<i>A</i>	2,000	×	Rs. 80	=	1,60,000
<i>B</i>	1,600	×	40	=	64,000
<i>C</i>	2,400	×	60	=	1,44,000
Total					3,68,000
Less : Fixed Expenses					2,76,000
Profit					92,000
					=====

- (b) Overall break-even point of company for the month based on the mix calculated in (a) above.

BES	×	P/V ratio	=	Fixed Cost
or BES	×	$(3,68,000 \div 8,96,000^*)$	=	Rs. 2,76,000
or BES	=	Rs. 6,72,000		

Total Sales :

	Units		S.P. per unit		Total Sales
<i>A</i>	2,000	×	200	=	Rs. 4,00,000
<i>B</i>	1,600	×	160	=	2,56,000
<i>C</i>	2,400	×	100	=	2,40,000
					8,96,000
					=====

C.A. Inter, November 1988

For question on Flexible Budget—Average Cost and B.E. level, please see Problem 11.1 on page P11.1.

Apportionment of Joint Costs (Maximum Price to be paid for raw materials)

Problem 7. *JB* Limited produces four joint products *A*, *B*, *C*, and *D*, all of which emerge from the processing of one raw material. The following are the relevant data :

Production for the period :—

Joint Products	Number of units	Selling price per unit
<i>A</i>	500	Rs. 18.00
<i>B</i>	900	8.00
<i>C</i>	400	4.00
<i>D</i>	200	11.00

The company budgets for a profit of 10% of sales value. The other estimated costs are :

Carriage inwards	Rs. 1,000
Direct wages	5,000
Manufacturing overhead	2,000
Administration overhead	10% of sales value

You are required to:

- (a) Calculate the maximum price that may be paid for the raw material.
- (b) Prepare a comprehensive cost statement for each of the products allocating the materials and other costs based upon
 - (i) number of units
 - (ii) sales value.

Solution.

<i>Joint products</i>	<i>No. of units</i>	<i>S.P. per unit</i>	<i>Sales Value</i>
<i>A</i>	500	Rs. 18	Rs. 9,000
<i>B</i>	900	8	7,200
<i>C</i>	400	4	1,600
<i>D</i>	200	11	2,200
			<hr/>
Total Sales value			20,000
Less Budgeted profit (10%)			2,000
			<hr/>
Total Joint Costs			18,000

(a) Maximum price to be paid for R.M.

Total Joint Costs	Rs. 18,000
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Less Other costs :

Carriage inwards	Rs. 1,000	
Direct wages	3,000	
Manufacturing overhead	2,000	
Admn. overhead	2,000	8,000
	<hr/>	<hr/>

Maximum price to be paid for R.M.	10,000
	<hr/>

(b) (i) Comprehensive Cost Statement (based on No. of units)

	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>Total</i>
No. of units	500	900	400	200	2,000
	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
R.M. @ Rs. 5	2,500	4,500	2,000	1,000	10,000
Carriage @ Re. 0.5	250	450	200	100	1,000
Direct wages @ Rs. 1.5	750	1,350	600	300	3,000
Mfg. Ohd. @ Re. 1	500	900	400	200	2,000
Adm n. Ohd. @ Re. 1	500	900	400	200	2,000
	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
Total	4,500	8,100	3,600	1,800	18,000
	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>

(b) (ii) Comprehensive Cost based on Sales Value (Rs.)

	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>Total</i>
Sales Value	9,000	7,200	1,600	2,200	20,000
Raw Material	4,500	3,600	800	1,100	10,000
Carriage	450	360	80	110	1,000
Direct Wages	1,350	1,080	240	330	3,000
Mfg. Ohd.	900	720	160	220	2,000
Admn. Ohd.	900	720	160	220	2,000
Total cost	8,100	6,480	1,440	1,980	18,000

For question of Sales Variance—Missing values (please refer to Problem 12.15 on page P. 12.20.)

Effect of change in Cost, Volume and Price (Missing Values)

Problem 8 Frazer Ltd. manufactures and sells a product, the selling price and raw material cost of which have remained unchanged during the past two years. The following are the relevant data : —

<i>Particulars</i>	<i>Year 1</i>	<i>Year 2</i>
Quantity sold (Kg)	100	150
Sales value	Rs. 20,000	Rs. ?
Raw materials	10,000	?
Direct wages	3,000	?
Factory overheads	5,000	5,700
Profit	2,000	2,550

During year 2, direct wage rates increased by 50%, but there was a saving of Rs. 300 in fixed factory overheads.

Required :

What quantity (in kg.) the company should have produced and sold in year 2 in order to maintain the same amount of net profit per kg as it earned during year 1 ? (Workings to form part of the answer).

Solution. Statement showing the quantity (in kgs) to be produced and sold in year 2

Selling price per kg. (Rs. 20,000 ÷ 100)	Rs. 200
Less : Variable cost per kg.	
Raw Material	Rs 100
Direct wages (Rs. 30 × 150%)	45
Variable factory overhead (Note 1)	20
	— — —
	165
Contribution	35
Less : Profit	20
	— — —

Balance contribution per kg. for meeting fixed cost.	15
Fixed Cost (Note 2)	Rs. 2,700
Quantity per kg produced and sold ($\text{Rs. } 2,700 \div 15$)	180 kg.

Notes 1. Variable Factory Overhead per kg.

Total factory overhead in year 2	Rs. 5,700
Add Saving in F.O. "	300

6,000

Less F.O. in year 1	5,000
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Increase in F.O.	1,000
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Increase in quantity	50 kg
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Variable F.O. rate	Rs. 20
--------------------	--------

2. Fixed Factory Overhead

	Year 1	Year 2
Total factory overhead	Rs. 5,000	Rs. 5,700
Less Variable F.O.	2,000	3,000
Fixed Factory overhead	3,000	2,700

C.A. Final, May 1988**Job Costing (Consolidated overall income statement)**

Problem 9 Kamyabi Combines accepts orders from customers to manufacture engineering equipments according to their specifications. The company operates a Job Costing system. Each equipment order is given a Job number and the Job passes through two departments, viz., Fabrication and Finishing. Material and Labour are booked to the appropriate Job numbers while Overhead is applied based on labour hours.

The data for April 1988 are given below :

(i) Opening Stock on 1-4-88	Rs.
Raw Materials	42,500
Work-in-Progress	43,860
Finished Jobs — No. 21	22,000
" 25	18,000
" 26	27,600

Details of Work-in-progress are available :

	Job No	23	24	Total
Fabrication	Material	Rs. 12,000	Rs. 16,800	Rs. 28,800
	Labour	768	1,440	2,208
	Overhead	1,152	2,160	3,312
	Sub-total	13,920	20,400	34,320

Finishing	Material	3,000	5,000	8,000
	Labour	320	450	770
	Overhead	320	450	770
	Sub-total	3,640	5,900	9,540
Total		17,560	26,300	43,860

(i) Purchases of Materials during the month Rs. 24,200.

(ii) Materials requisitioned :

	<i>Fabrication</i>	<i>Finishing</i>
Job No. 23	Rs. 2,400	Rs. 600
" " 24	2,800	1,400
" " 27	6,800	1,700
" " 29	11,000	7,000

(iii) Labour, based on time taken

Job No.	Hours		Cost Rs.	
	<i>Fabrication</i>	<i>Finishing</i>	<i>Fabrication</i>	<i>Finishing</i>
23	72	24	576	240
24	48	16	384	160
27	64	16	512	160
29	160	64	1,280	640

(iv) Indirect Labour 1,000 48

(v) Fringe benefits paid to employees 12% on total labour cost borne equally by the 2 departments.

(vi) Overhead Expenses

	<i>Fabrication</i>	<i>Finishing</i>
Consumables	Rs. 400	Rs. 100
Insurance	300	100
Property Tax	440	110
Depreciation	1,200	300
Repairs	180	140
Miscellaneous	200	70

(vii) Administration and Selling Expenses Rs. 5,120.

(ix) The Overhead absorption rates per direct labour are Rs. 12 for Fabrication and Rs. 10 for Finishing Department.

(x) Production for Job No. 24 and 29 was completed during the month.

(xi) Job Nos. 25, 26 and 29 were sold for Rs. 25,200, Rs. 40,000 and Rs. 41,000 respectively.

With the help of the above data, you are required to prepare the following :

- A Tabular Statement showing the total costs incurred in April detailing each element of cost jobwise and departmentwise (in the same format as given above for details of work-in-progress at the beginning of the month).
- A simple statement departmentwise of overheads under or over-absorbed during the month.
- A brief consolidated overall income statement for April 1988 showing therein clearly sales, cost of sales and variations in stock and work-in-progress figures.

Solution.

(a) Statement showing the cost incurred in April 1988

Job No.	23	24	27	29	Total
Fabrication					
Material	Rs. 2,400	Rs. 2,800	Rs. 6,800	Rs. 14,000	Rs. 26,000
Labour	576	384	512	1,280	2,752
Overhead (50% of Labour Cost*)	864	576	768	1,920	4,128
Sub-total	<u>3,840</u>	<u>3,760</u>	<u>8,080</u>	<u>17,200</u>	<u>32,880</u>
Finishing					
Material	600	1,400	1,700	2,000	10,700
Labour	240	160	160	640	1,200
Overhead (50% of Labour Cost)*	240	60	160	640	1,200
	<u>1,080</u>	<u>1,720</u>	<u>2,020</u>	<u>8,280</u>	<u>13,100</u>
Total	<u><u>4,920</u></u>	<u><u>5,480</u></u>	<u><u>10,100</u></u>	<u><u>25,480</u></u>	<u><u>45,980</u></u>

*as per data given for completed orders.

(b) Statement showing departmentwise under/overabsorption of overhead during the month

	Fabrication	Finishing
Indirect Labour	Rs. 1,000	Rs. 48
Fringe benefits	300	300
Consumables	400	100
Insurance	300	100
Property tax	440	110
Depreciation	1,200	300
Repair	480	140
Miscellaneous	200	70
	<u> </u>	<u> </u>

Actual overhead	4,320	1,168
Applied overhead	4,128	1,200
	<hr/>	<hr/>
Under/overabsorbed overhead	192	(32)
	<hr/>	<hr/>

Overhead overabsorbed = Rs. 32

Overhead underabsorbed = Rs. 192

*12% of (Rs. 2,752 + Rs. 1,200 + Rs. 1,000 + Rs. 48) divided equally.

(c) Consolidated overall Income Statement for April, 1988

	Rs.	Rs.
Sales (Rs. 25,200 + Rs. 40,000 + Rs. 41,000)	(A)	1,06,200
		<hr/>

Material Consumed :

Opening Stock	42,500	
Add Purchases	24,200	
	<hr/>	
	66,700	
Less Closing stock (Balancing figure)	30,000	36,700*
	<hr/>	

*Rs. 26,000 + Rs. 10,700 as per (a)

D. Labour (Rs. 2,752 + Rs. 1,200) 3,952

Overhead (Absorbed) (Rs. 4,128 + Rs. 1,200) 5,328

Decrease in W.I.P.

Op. Balance	Rs. 43,860	
Less Closing stock (Order No. 23 and 27)		
(Rs. 17,560 + Rs. 4,920 + Rs. 10,100)	32,580	11,280
	<hr/>	

Decrease in F/Stock

Op. Stock (Rs. 22,000 + 18,000 + 27,600)	Rs. 67,600	
C/Stock	53,780*	13,820
	<hr/>	

Administration and Selling Expenses 5,120

Cost of Sales (B) 76,200

Income for the month (A - B) without adjustment for over/underoverhead 30,000

Adjustment for over/underabsorption (Rs. 192 - Rs. 32) 160

Profit for April 29,840

*Only order No. 22 and Order No. 24 are in closing finished stock.
i.e., Rs. 22,000 + Rs. 26,300 + Rs. 5,480 = Rs. 53,780

Note. For Profit, income should be reduced by Raw Material consumed, D.L. Expenses, production overhead, accretion/decretion of inventory adjusting for over/underabsorbed overhead.

For question on Job Costing—Computation of manufacturing cost of different sizes of pipe, please refer to Problem 5.14 at page P. 5.21.

Decision Making (Quoting for an order)

Problem 10. A small scale manufacturer produces an article at the operated capacity of 10,000 units while the normal capacity of his plant is 14,000 units. Working at a profit margin of 20% on sales realisation, he has formulated his Budget as under :

	10,000	14,000
Sales Realisation	Rs. 2,00,000	Rs. 2,80,000
Variable overheads	50,000	70,000
Semi-variable overheads	20,000	22,000
Fixed overheads	40,000	40,000

He gets an order for a quantity equivalent to 20% of the operated capacity and even on this additional production, profit margin is desired at the same percentage on Sales Realisation as for production to operated capacity.

Assuming prime cost is constant per unit of production, what should be the minimum price to realise this objective?

Solution : (i) Computation of Prime Cost

Sales at operated capacity	Rs. 2,00,000
Less Profit margin (20% of sales)	40,000
Cost of sales	1,60,000
Less Overheads :	
Variable O.H.	Rs. 50,000
Semi-variable O.H.	20,000
Fixed overhead	40,000
Prime Cost	50,000

(ii) Statement showing differential cost for 2,000 units

	Cost of 10,000 units	Cost of 12,000 units	Diff. Cost for 2,000 units
Prime Cost	Rs. 50,000	Rs. 60,000	Rs. 10,000
V. Cost	Rs. 50,000	Rs. 60,000	Rs. 10,000
Semi V.O.H.	Rs. 20,000	Rs. 21,000*	Rs. 1,000
Fixed O.H.	Rs. 40,000	Rs. 40,000	—
	1,60,000	1,81,000	21,000

*A review of semi-variable overhead for 10,000 units and 14,000 units reveals that increase of 4,000 units leads to an increase of 2,000. Therefore, increase of 2,000 units will lead to increase of Rs. 1,000 in semi-variable overhead. Differential cost per unit relating to :

Additional 2000 units (i.e. Rs. 2100 ÷ 2000)	—Rs. 10.50
Profit : 20% of Sales or 25% of Cost	26.5

Hence minimum selling price to realise the given objective.

13.125

Standard Costing (Equivalent Production with Variance Analysis)

Problem 11. File and Smile Associates undertake to prepare income tax returns for individuals for a fee. Their advice to their clients is to pay the proper tax and relax. In order to arrive at the proper scale of fees and assess their own performance, they have a good system. They use the weighted average method and actual costs for financial reporting purposes. However, for internal reporting, they use a standard cost system. The standards, based on equivalent performance, have been established as follows :

Labour per return	5 hrs. @ Rs. 40 per hr.
Overhead per return	5 hrs. @ Rs. 20 per hr.

For March 1988 performance, budgeted overhead is Rs. 98,000 for the standard labour hours allowed. The following additional information pertains to the month of March 1988 :

March 1	Returns in Process (25% Complete)	200 Nos.
	Returns started in March	825 Nos.
March 31	Returns in Process (80% Complete)	125 Nos.

Cost data

March 1	Returns in Process :	
	Labour	Rs. 12,000
	Overheads	5,000
March 1 to 31	Labour	
	4,000 hrs.	1,78,000
	Overheads	90,000

You are required to compute :

(a) for each cost element, equivalent units of performance and the actual cost per equivalent unit,

(b) actual cost of returns in process on March 31,

(c) the standard cost per return, and

(d) the total labour, labour rate and labour efficiency variances as well as total overhead volume and overhead budget variances.

Solution. (a) Statement showing cost elements, equivalent units of performance and the actual cost per equivalent unit :

<i>Details of returns</i>				<i>Equivalent Units</i>		
				<i>Labour</i>	<i>Overheads</i>	
<i>Input Details</i>	<i>Units</i>	<i>Output Details</i>	<i>Units</i>	<i>Units</i>	<i>%</i>	<i>Units</i>
Return in process at start	200	(a) Returns completed in March	900	900*	100%	900
Returns started in March	825	(b) Returns in process at the end of March	125	100		100%
						80%
	1,025		1,025	1,000		1,000
	==		==	==		==
<i>Costs :</i>						
From previous month				Rs. 12,000		Rs. 5,000
During the month				1,78,000		90,000
				==		==
Total Cost				1,90,000		95,000
				==		==
Cost per equivalent unit				Rs. 190		Rs. 95

* Since Company follows Weighted Average Method, the stages of completion of returns at the beginning of March has been ignored.

(b) The standard Cost per return

Actual Cost of returns in process on March 31

	No.	Stage of completion	Rate per return	Total
Labour	125 returns	$\times 0.80$	$\times 190$	Rs. 19,000
Overhead	125 returns	$\times 0.80$	$\times 95$	9,500
				<u>28,500</u>
				== ==

(c) Standard cost per return

Labour	5 hrs. \times Rs. 40 per hour	=	Rs. 200
Overhead	5 hrs. \times Rs. 20 per hour	=	100
			<u>300</u>
			==

(d) Computation of VariancesStatement showing output
(March only) elementwise

	Labour	Overhead
Actual performance in March in terms of equivalent units as per (a)	1,000	1,000
Less Returns in process at the beginning of March in terms of equivalent units, i.e., 25% of 200 returns	50	50
	<u>950</u>	<u>950</u>
Returns completed in March in terms of equivalent units	950	950
	==	==

Variance Analysis**Labour Variances**

L₁ —Actual Payment to works for 4,000 hours (given)	Rs. 1,78,000
L₂ —Payment involved if the worker had been paid at standard rate (4,000 hrs \times Rs. 40)	Rs. 1,60,000
L₃ and L₄ —not applicable.	
L₅ —Standard labour cost of output achieved	
950 returns \times 5 hrs. \times Rs. 40	1,90,000

Labour Rate Variance

$$L_1 - L_2 = \text{Rs. } 1,78,000 - \text{Rs. } 1,60,000 = \text{Rs. } 18,000 \text{ (A)}$$

Labour Efficiency Variance

$$L_2 - L_3 = \text{Rs. } 1,60,000 - \text{Rs. } 1,90,000 = \text{Rs. } 30,000 \text{ (F)}$$

Labour Cost Variance

$$L_1 - L_3 = \text{Rs. } 1,78,000 - \text{Rs. } 1,90,000 = \text{Rs. } 12,000 \text{ (F)}$$

Overhead Variances

$$FO_1 - \text{Actual Overhead incurred} \quad \text{Rs. } 90,000$$

$$FO_2 - \text{Budgeted Overhead} \quad \text{Rs. } 98,000$$

$$FO_3 - \text{Not Applicable.}$$

$$FO_4 - \text{Standard cost of labour hours utilized} \\ 400 \text{ hrs.} \times \text{Rs. } 20 \quad \text{Rs. } 80,000$$

$$FO_5 - \text{Standard fixed overhead for production} \\ 950 \text{ returns} \times 5 \text{ hrs.} \times \text{Rs. } 20 \quad \text{Rs. } 95,000$$

Overhead Expenditure or budgeted variance

$$= FO_1 - FO_2 = \text{Rs. } 90,000 - \text{Rs. } 98,000$$

$$= \text{Rs. } 8,000 \text{ (F)}$$

Overhead Capacity Variance

$$= FO_2 - FO_4 = \text{Rs. } 98,000 - \text{Rs. } 80,000$$

$$= \text{Rs. } 18,000 \text{ (A)}$$

Overhead Efficiency Variance

$$= FO_4 - FO_5 = \text{Rs. } 80,000 - \text{Rs. } 95,000$$

$$= \text{Rs. } 15,000 \text{ (F)}$$

Overhead Volume Variance

$$= FO_2 - FO_3 = \text{Rs. } 98,000 - \text{Rs. } 95,000$$

$$= \text{Rs. } 3,000 \text{ (A)}$$

Overhead Cost Variance

$$= FO_1 - FO_5 = \text{Rs. } 90,000 - \text{Rs. } 95,000$$

$$= \text{Rs. } 5,000 \text{ (F)}$$

Make or Buy (Cash Flows)

Problem 12. A firm needs a component in an assembly operation. If it wants to do the manufacturing itself, it would need to buy a machine for Rs. 4 lakhs which would last for 4 years with no salvage value. Manufacturing costs in each of the 4 years would be Rs. 6 lakhs, Rs. 7 lakhs, Rs. 8 lakhs and Rs. 10 lakhs respectively. If the firm had to buy the component from a supplier the component would cost Rs. 9 lakhs, Rs. 10 lakhs, Rs. 11 lakhs and Rs. 14 lakhs respectively in each of the 4 years. However, the machine would occupy floor space

which could have been used for another machine. This latter machine could be hired at no cost to manufacture an item, the sale of which would produce net cash flows in each of the 4 years of Rs 2 lakhs; it is impossible to find room for both the machines and there are no other external effects. The cost of capital is 10% and PV factor for each of the 4 years is 0.909, 0.826, 0.751 and 0.683 respectively. Should the firm make the component or buy from outside?

Solution. Statement evaluating Make or Buy Proposal

(Rs. in lakhs)

Year	Present Value factor at 10%	When the Component is manufactured		When the Component is bought	
		Outflow	Present Value	Capital Cost, Opportunity Cost	Present Value
0	1.000	4	4.000		
1	0.909	6.12	5.563	0	8.180
2	0.826	7.11	5.863	10	8.260
3	0.751	8.12	6.099	11	8.261
4	0.683	10.12	6.906	14	9.562
			31.412		34.263

Saving in buying = Rs. 31.412 - Rs. 34.263 = Rs. 2.851 lakhs

Therefore, it is beneficial to buy.

Note. The loss of cash inflow of Rs 2 lakhs for each of the 4 years due to inability of firm to operate another machine when it manufactures the component is to be treated as opportunity cost.

C.A. Final November, 1988

For question on Budgeted Balance Sheet, please refer to Problem 11.26 at page P 11.65.

For question on Maximising total of product mix with two limiting factors, please refer to Problem 9.2 at page P 9.3.

B.E. Analysis (B.E. Units and Reduction in Fixed Expenses)

Problem 13. Ever Forward Ltd. is manufacturing and selling two products : Splash and Flash, at selling prices of Rs. 3 and Rs. 4 respectively. The following sales strategy has been outlined for the year 1989 :

- Sales planned for year will be Rs. 7.20 lakhs in the case of Splash and Rs. 3.50 lakhs in the case of Flash.
- To meet competition, the selling price of Splash will be reduced by 20% and that of Flash by 12½%.
- Break-even is planned at 60% of the total sales of each product.
- Profit for the year to be achieved is planned at Rs. 69,120 in the case of Splash and Rs. 17,500 in the case of Flash. This

would be possible by launching a cost reduction programme and reducing the present annual fixed expenses of Rs. 1,35,000 allocated as Rs. 1,08,000 to Splash and Rs. 27,000 to Flash.

You are required to present the proposal in financial terms giving clearly the following information :

- (a) Number of units to be sold of Splash and Flash to break-even, as well as the total number of units of Splash and Flash to be sold during the year.
- (b) Reduction in fixed expenses product-wise that is envisaged by the Cost Reduction Programme.

Solution.

Ever Forward Ltd

- (a) **Number of units sold to B.E. and total units to be sold during 1989**

	<i>Total</i>	<i>Splash</i>	<i>Flash</i>
	Rs. 10,70,000	Rs. 7,20,000	Rs. 3,50,000
Planned Sales			
Selling price per unit			
after reduction		2.40	3.50
Total sales (units)	4,00,000	3,00,000	1,00,000
B.E. sales (units)			
60% of total sales	2,40,000	1,80,000	60,000
(b) Reduction in Fixed Expenses Product-wise			
B.E. Sales (60% of planned sales)	Rs. 6,42,000	Rs. 4,32,000	Rs. 2,10,000
Margin of Safety (40% of planned sales)	4,28,000	2,88,000	1,40,000
Planned profit	86,620	69,120	17,500
P/V Ratio = Profit/M.S.		24%	12.5%
Fixed Cost* at B.E.			
Sales	1,29,930	1,03,680	26,250
Existing fixed expenses	1,35,000	1,08,000	27,000
Saving in fixed expenses	5,070	4,320	750

*At B.E. sales, profit is zero.

For question on Modernisation Decisions—Replacement of Old Machine, please refer to Problem 10.22 on page P 10.46.

Pricing (Return on Capital Employed)

Problem 14. The cost profile of a company, manufacturing only one product, is as under :

	Rs.
Direct material	5.60
Direct labour	1.50
Variable factory overhead	0.40
	<hr/>
	7.50

Fixed factory overhead is budgeted at Rs. 3,30,000 for an annual sales of 4,00,000 units.

Selling, Distribution and Administration costs are budgeted at Rs. 1,80,000.

Capital employed is Rs. 4,50,000 in fixed assets and 50% of sales in current assets.

Determine a selling price for the product to yield a 20% return on capital employed.

Production Decision (Wage increase linked to productivity)

(b) In its round of talks with the representatives of the Trade Union, Amicable Relations Ltd. is faced with a Union demand for an increase of 15% on the hourly wage rates, in response to a management offer of 5%.

The management is most reluctant to agree to such a demand but is willing to consider making an increased offer provided that it influences productivity. The suggestion is to offer 5% on basic hourly rates plus Re. 0.15 for every standard hour of output produced. If this is agreed to, it is expected that production would increase by 10% within the budgeted hours (normal factory capacity).

In order to sell the increased output, it would become necessary to effect a reduction of $2\frac{1}{2}\%$ in the selling price.

The draft budget for the forthcoming year, excluding the wages and sales increase, are :

	Rs. in lakhs
Sales (15,00,000 units)	60
Direct Material	12
Direct Wages	18
Variable Production Overhead	3
Fixed Production Overhead	10
Variable Sales Overhead (5% of turnover)	3
Fixed Sales Overhead	6
Variable Distribution Overhead	1
Fixed Distribution Overhead	1
Fixed Administration Overhead	2
	<hr/> 56
Profit	<hr/> 4

You are required to work out the alterations in the budget :

- if the trade union demand is accepted by management,
- if the management's proposal of wage increase linked to productivity is accepted by the trade union.

Also work out the minimum output necessary for the management's proposal to be more rewarding to the labour force than a 15% wage increase.

Solution

- (a) **Determining selling price per unit for the product to yield a 20% return on capital employed :**

Capital employed = Fixed Assets + Current Assets
= Rs. 4,50,000 + 50% of Sales

Profit : 20% on Capital employed
= 20% (Rs. 4,50,000 + 50% of Sales)
= Rs. 90,000 + 10% of sales

	Rs.
Variable Cost : 4,00,000 × Rs. 7.50	30,00,000
Fixed Factory Overhead	3,30,000
Selling, Dist. & Admin. Costs	1,80,000
	<hr/>
Total Cost	35,10,000
	<hr/>

Sales = Total Cost + Profit
= Rs. 35,10,000 + (Rs. 90,000 + 10% Sales)

90% Sales = Rs. 36,00,000

∴ 100% Sales = Rs. 40,00,000

∴ Selling price per unit = Rs. 40,00,000 ÷ 4,00,000 = Rs. 10.

- (b) **Revised budget if Trade Union demand is accepted :**

		Rs. in lakhs
Sales 15,00,000 Units		60
Variable Costs		
Direct Material	12	
Direct Wages (Rs. 18 lakh + 15% of Rs. 12 lakh)	20.7	
Variable Production Overhead	3	
Variable Sales Overhead	3	
Variable Distribution Overhead	1	39.7
	<hr/>	
Fixed Costs		
Fixed Production Overhead	10	
Fixed Sales Overhead	6	
Fixed Distribution Overhead	1	
Fixed Administration Overhead	2	19.0
	<hr/>	
Total Costs		58.7
		<hr/>
Profit		1.3
		<hr/>

(ii) Revised budget if Management's proposal is accepted :

	Rs. in lakhs
Sales 16,50,000 Units at Rs. 3.90	64.3500
<i>Variable Costs :</i>	
Direct Material	13.2000
Direct Wages (Rs. 18 lakhs \times 1.05 + 16.5 lakhs \times Re. 0.15)	21.3750
Variable Production Overhead	3.3000
Variable Sales Overhead (5% of 64.35)	3.2175
Variable Distribution Overheads	1.1000
	<hr/> 42.1925
Fixed Costs	19.0000
	<hr/>
Total Costs	61.1925
	<hr/>
Profit	3.1575
	<hr/>

Minimum Output necessary for the management's proposal to be more rewarding to the labour force than a 15% wage increase

	Rs. in lakhs
Direct wages at 115% of basic hourly rate	20.7
Direct wages at 105% of basic hourly rate	18.9
	<hr/>
Difference between the two	1.8
Break-even Production = $1.8 \div 0.15 = 12$ lakh units	

Note It has been assumed that one unit of output represents one standard hour of output.

C.I.M.A. London May 1988**Marginal Costing vs. Absorption Costing (Use of Equivalent Unit Concept)**

Problem 15. A new subsidiary of a group of companies was established for the manufacture and sale of product X. During the first year of operations 90,000 units were sold at Rs. 20 per unit. At the end of the year, the closing stocks were 8,000 units in finished goods store and 4,000 units in work-in-progress which were complete as regards material content but only half complete in respect of labour and overheads. You are to assume that there were no opening stocks.

The work-in-progress account had been debited during the year with the following costs :

Direct materials	Rs. 7,14,000
Direct Labour	4,00,000
Variable overhead	1,00,000
Fixed overhead	3,50,000

Selling and administration costs for the year were :

	<i>Variable cost per unit sold</i>	<i>Fixed cost</i>
Selling	Rs. 1.50	Rs. 2,00,000
Administration	0.10	50,000

The accountant of the subsidiary company had prepared a profit statement on the absorption costing principle which showed a profit of Rs. 11,000.

The financial controller of the group, however, had prepared a profit statement on a marginal costing basis which showed a loss. Faced with these two profit statements, the director responsible for this particular subsidiary company is confused.

You are required to :

- prepare a statement showing the equivalent units produced and the production cost of one unit of Product X by element of cost and in total ;
- prepare a profit statement on the absorption costing principle which agrees with the company accountant's statement ;
- prepare a profit statement on the marginal costing basis ;
- explain the differences between the two statements given for (b) and (c) above to the director in such a way as to eliminate his confusion and state why both statements may be acceptable.

Solution. (a) Statement of Equivalent Production

<i>Input (units)</i>	<i>Details</i>	<i>Output (units)</i>	<i>Equivalent Production</i>			
			<i>D.M.</i>	<i>D.W.</i>	<i>V.O.</i>	<i>F.O.</i>
102,000	Sales	90,000	90,000	90,000	90,000	90,000
	Finished Goods	8,000	8,000	8,000	8,000	8,000
	W.I.P.	4,000	4,000	2,000	2,000	2,000
<hr/>		<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
102,000		1,02,000	1,02,000	1,00,000	1,00,000	1,00,000

*D.M.=100% Complete

Others=50%

Statement of cost of Each Element

<i>Element of Cost</i>	<i>Cost (Rs.)</i>	<i>Equivalent production (units)</i>	<i>Cost per unit (Rs.)</i>
Direct Materials	7,14,000	1,02,000	7 00
Direct Labour	4,00,000	1,00,000	4 00
Variable Overhead	1,00,000	1,00,000	1 00
Fixed Overhead	3,50,000	1,00,000	3 50
<hr/>			<hr/>
Total			15 50

(b) Profit statement based on absorption costing

Sales 90,000 units at Rs. 20

Rs. 18,00,000

Production costs :

Materials	Rs. 7,14,000
Labour	4,00,000
Variable overhead	1,00,000
	<hr/>
	12,14,000
Fixed overhead	3,50,000
	<hr/>
	15,64,000

Less : Closing stocks

Rs. '000

8,000 units	×	Rs. 15.5	=	124
4,000	×	7.0	=	28
2,000	×	4.0	=	8
2,000	×	1.0	=	2
2,000	×	3.5	=	7

169

1,69,000

13,95,000

Gross profit

4,05,000

Less : Selling costs : Variable 90,000 × 1.50 = 1,35,000

Fixed 2,00,000

Administration : Variable 90,000 × 0.10 = 9,000

Fixed 50,000

3,94,000

Net profit

11,000

(c) Profit statement based on marginal costing

Sales 90,000 units at Rs. 20

Rs. 18,00,000

Less : Marginal cost of production Rs. 12,14,000

Less : Closing stocks Rs. '000

Finished goods 8,000 × 12.0 = 96

Work-in-progress 4,000 × 7.0 = 28

2,000 × 4.0 = 8

2,000 × 1.0 = 2

1,34,000

10,80,000

Add : Variable selling

135

Variable administration

9

1,44,000

Variable cost of sales		12,24,000
Contribution	Rs. '000	5,76,000
Less : Fixed costs : Production	350	
Selling	200	
Administration	50	
		6,00,000
Net loss		(24,000)

(d) Profit under absorption costing 11,000

	Absorption	Marginal	Difference
Finished goods stocks	Rs. 1,24,000	Rs. 96,000	Rs. 28,000
Work-in-progress stocks	45,000	38,000	7,000
			(35,000)
Loss under marginal costing			(24,000)

It is often said that absorption costing favours production, while marginal costing favours sales. This situation arises if, during an accounting period, production is greater than sales, then stocks will increase, or if sales are greater than production, then stocks will decrease.

In an absorption costing system, stocks are valued at marginal cost plus all related production overheads, whilst in a marginal costing system, stocks are valued at marginal costs only. Inevitably, this results in stock being valued at a larger amount in an absorption costing system than in a marginal costing system. Thus, in (b) and (c) above, production was greater than sales, so the results show that in the absorption costing statement, profit was Rs. 11,000, while in the marginal costing statement there was a loss of Rs. 24,000.

Both statements are acceptable in the sense that they are correct interpretations of the concept of both accounting systems. For internal accounting purposes, either system may be used, but for external accounting purposes, the procedures set out in SSAP-9 should be followed which would result in the adoption of absorption costing principles.

Variance Analysis—Miscellaneous (Reconciliation)

Problem 16 (a) Discuss in general the ways in which variance analysis helps management of a business.

(NOTE—there is no need to refer to specific variances)

(b) NC Limited uses flexible budgets and standard costing for its single product P which it makes and sells.

Three kilogrammes of material, having a standard cost of Rs. 4.40 per kilogramme, are required for each unit of P. Actual material pur-

chased and used in April cost Rs. 3,36,000 with the actual purchase price being Rs. 4.20 per kilogramme. Each unit of *P* requires thirty minutes of direct labour time and the standard wages rate per hour is Rs. 5. The actual wages rate in April was Rs. 5.40 per hour. Sufficient direct labour time was utilised to produce 28,000 units of *P* although actual production in April was 25,000 units.

The company has a normal operating capacity of 15,000 hours per month and flexible overhead budgets are :

Hours of operation	12,500	14,000	15,000
Variable production overhead	Rs. 1,50,000	Rs. 1,68,000	Rs. 1,80,000
Fixed production overhead	2,70,000	2,70,000	2,70,000
	<hr/> 4,20,000	<hr/> 4,38,000	<hr/> 4,50,000

Actual overhead incurred in April was Rs. 4,30,000 of which Rs. 2,70,000 was fixed.

You are required to :

- calculate the appropriate variances for material, labour and overhead ;
- show the variances in a statement suitable for presentation to management, reconciling the standard cost with the actual cost of production.

Solution. (a) Please refer to "Advanced Cost and Management Accounting—Text" by Saxena and Vashist.

(b) (i) It is useful but not essential to set out the standard cost, i.e., Standard cost per unit of product *P*

Material	3 kg × Rs. 4.40	Rs. 13.20
Labour	0.5 hr × Rs. 5.00	Rs. 2.50
Variable OH	0.5 hr × Rs. 12*	6.00
Fixed OH	0.5 hr × Rs. 18*	9.00
		<hr/> 30.70

*Variable O.H. rate = Rs. 1,80,000 ÷ 15,000 = Rs. 12 per hr.

*Fixed O.H. rate = Rs. 2,70,000 ÷ 15,000 = Rs. 18 per hr.

For Material Variances

M_1 Actual cost of material used Rs. 3,36,000

M_2 Standard cost of material used
(AQ × Std Rate) * 80,000 × Rs. 4.40 3,52,000

M_3 Not applicable

M_4 Standard cost of output (standard quantity of material required for specified output × Std. Rate) *
75,000* × Rs. 4.40 Rs. 3,30,000

Material Price Variance ($M_1 - M_2$) 16,000 (F)

Material Usage Variance ($M_2 - M_4$) 22,000 (A)

*Rs. 3,36,000 ÷ Rs. 4.20 = 80,000 kg. 25,000 × 3 kg = 75,000

For Labour Variances

L_1 Actual payment made to workers for actual hours worked Rs. $14,000 \times \text{Rs. } 5.40$	Rs. 75,600
L_2 Payment involved if workers had been paid at standard rate $14,000 \times 5$	70,000
L_3 Not applicable	
L_4 Std. cost of output achieved $25,000 \times (\text{Rs. } 5.00 \div 30 \text{ minutes per unit})$	62,500
Direct labour rate variance ($L_1 - L_2$)	5,600 (A)
Direct labour efficiency variance ($L_2 - L_4$)	7,500 (A)

For Variable Overhead Variances

VO_1 —Actual variable overhead Rs. $4,30,000 - \text{Rs. } 2,70,000$	= Rs. 1,60,000
VO_2 —Actual hours worked at Standard V.O.H. rate $28,000 \times 0.5 \text{ hr} \times \text{Rs. } 12$	= Rs. 1,68,000
VO_3 —Standard variable O.H. for production $25,000 \text{ units} \times 0.5 \text{ hr} \times \text{Rs. } 12$	= Rs. 1,50,000
Variable O.H. Expenditure variance = $VO_1 - VO_2$ = Rs. $1,60,000 - \text{Rs. } 1,68,000$ = Rs. 8,000 (F)	
Variable O.H. Efficiency variance = $VO_2 - VO_3$ = Rs. $1,68,000 - \text{Rs. } 1,50,000 = \text{Rs. } 18,000$ (A)	

For Fixed Overhead Variances

FO_1 —Actual fixed overhead incurred	= Rs. 2,70,000
FO_2 —Budgeted Fixed Overhead	= Rs. 2,70,000
FO_3 —Fixed OH for days/hours available at standard rate during the period $28,000 \times 0.5 \text{ hr} \times \text{Rs. } 9.00$	= Rs. 1,26,000
FO_4 —Fixed OH for actual hours worked at standard rate (All hours available were worked for)	= NIL
FO_5 —Standard Fixed OH for production = $25,000 \text{ units} \times \text{Rs. } 9.00$	Rs. = 2,25,000
Fixed OH Expenditure variance = $FO_1 - FO_2$ = Rs. $2,70,000 - \text{Rs. } 2,70,000$ = NIL	
Fixed OH Idle Time variance = $FO_2 - FO_3 = \text{Rs. } 2,70,000 - \text{Rs. } 1,26,000$ = Rs. 1,44,000 (A)	
Fixed OH Efficiency variance = $FO_3 - FO_5$ = Rs. $1,26,000 - \text{Rs. } 2,25,000$ = Rs. 99,000 (F).	
Fixed O.H. Volume variance = $FO_5 - FO_4$ = Rs. $2,70,000 - \text{Rs. } 2,25,000 = \text{Rs. } 45,000$ (A)	

Alternatively

$$\begin{aligned}
 & \text{Fixed OH Idle time variance} + \\
 & \text{Fixed OH capacity variance}^* + \\
 & \text{Fixed OH Efficiency variance} \\
 & = \text{Rs. 1,44,000 (A)} + \text{Rs. 99,000 (F)} \\
 & = \text{Rs. 45,000 (A)}.
 \end{aligned}$$

* In this question there is no capacity variance.

All hours available were worked for.

(b) (ii) Reconciliation

$$\text{Standard Cost } 25,000 \times \text{Rs. } 30.70 = 7,67,500$$

Variances

<i>Material</i>	<i>Favourable</i>	<i>Adverse</i>	
Price	Rs. 16,000		
Usage		Rs. 22,000	
<i>Labour</i>			
Rate		5,600	
Efficiency		7,500	
<i>Variable OH</i>			
Expenditure	8,000		
Efficiency		18,000	
<i>Fixed OH.</i>			
Expenditure			
Volume		45,000	74,100 (A)
Actual Cost			<u>8,41,600</u>

Verification

Actual Cost : Material	Rs 3,36,000	
Labour	75,600	
Production OH		
Fixed + Variable	4,30,000	Rs. 8,41,600
	<u> </u>	<u> </u>

Planning variance and Operating Variance

Problem 17. County Preserves produce jams, marmalade and preserves. All products are produced in a similar fashion ; the fruits are low temperature cooked in a vacuum process and then blended with glucose syrup with added citric acid and pectin to help setting.

Margins are tight and the firm operates a system of standard costing for each batch of jam.

The **standard cost** data for a batch of raspberry jam are :

Fruit extract	400 kg. @ Rs. 0.16 per kg.
Glucose syrup	700 kg. @ Rs. 0.10 per kg.

Pectin	99 kg. @ Rs. 0.332 per kg.
Citric acid	1 kg. @ Rs. 2.00 per kg.
Labour	18 hrs @ Rs. 3.25 per hour
Standard processing loss	3%

The summer of 1987 proved disastrous for the raspberry crop with a late frost and cool, cloudy conditions at the ripening period, resulting in a low national yield. As a consequence, normal prices in the trade were Rs. 0.19 per kg. for fruit extract although good buying could achieve some savings. The impact of exchange rates on imports of sugar has caused the price of syrup to increase by 20%.

The actual results for the batch were :

Fruit extract	428 kg. @ Rs. 0.18 per kg.
Glucose syrup	742 kg. @ Rs. 0.12 per kg.
Pectin	125 kg. @ Rs. 0.328 per kg.
Citric acid	1 kg. @ Rs. 0.95 per kg.
Labour	20 hrs @ Rs. 3.00 per hour

Actual output was 1,164 kg. of raspberry jam.

You are required to

- calculate the ingredients planning variances that are deemed uncontrollable ;
- calculate the ingredients operating variances that are deemed controllable ;
- calculate the mixture and yield variance ;
- calculate the total variance for the batch.

Solution. Workings .

Statement showing original, revised and actual data

<i>Original Standard</i>		<i>Revised Standard</i>		<i>Actual</i>	
400 × Re. 0.16 = Rs. 64		400 × Re. 0.19 = 76		428 × Re. 0.18	
				= Rs. 77.04	
700 × Re. 0.10 = Rs. 70		700 × Re. 0.12 = 84		742 × Re. 0.12	
				= 89.04	
99 × Re. 0.332 = Rs. 32.868		99 × Rs. 0.332 = 32.868		125 × Rs. 0.328	
				= 41.00	
1 × Rs. 2.00 = Rs. 2.00		1 × Rs. 2 = 2.0		1 × Re. 0.95	
				= 0.95	
<hr/> 1200		<hr/> 1200		<hr/> 1296	
Labour	168.868 58.500	Labour	194.868 58.500	Labour	208.03 60.00
<hr/> 1200		<hr/> 1200		<hr/> 1296	
36 Loss 3%	227.368	36 Loss 3%	253.368	132	268.03
<hr/> 1164		<hr/> 1164		<hr/> 1164	
<hr/> <hr/>		<hr/> <hr/>		<hr/> <hr/>	

(a) **Planning Variance** = Original Cost — Revised Cost

Fruit Extract = $64 - 76 = \text{Rs. } 12 \text{ (A)}$

Glycose Syrup = $70 - 84 = \text{Rs. } 14 \text{ (A)}$

Total = $227.368 - \text{Rs. } 253.368 = \text{Rs. } 26.00 \text{ (A)}$

(b) **Ingredient Operating Variance** : Revised — Actual

= $\text{Rs. } 194.868 - \text{Rs. } 208.03 = \text{Rs. } 13.162 \text{ (A)}$

For calculation of variances

M_1 — Actual cost of actual material = $\text{Rs. } 208.03$

M_2 — Standard Cost of material used

= $428 \times 0.19 = 81.32$

$742 \times 0.12 = 89.04$

$125 \times 0.332 = 41.50$

$1 \times 2.0 = 2.00$

= 213.86

===

M_3 — Standard Cost of Material if it had been used in standard proportion

$(400 \div 1200) \times 1296 \times 0.19 = 82.08$

$(700 \div 1200) \times 1296 \times 0.12 = 90.72$

$(99 \div 1200) \times 1296 \times 0.332 = 35.497$

$(1 \div 1200) \times 1296 \times 2 = 2.16$

= 210.457

===

M_4 — Standard material cost of output

$(194.868 \div 1164) \times 1164 = 194.868$

1. **Material Price Variance** = $M_1 - M_2$

= $\text{Rs. } 208.03 - 213.86 = \text{Rs. } 5.83 \text{ (F)}$

2. **Material Usage Variance** = $M_2 - M_3$

= $\text{Rs. } 213.86 - 194.868 = \text{Rs. } 18.992 \text{ (A)}$

3. **Labour Cost Variance** = Actual Cost — Standard Cost

= $\text{Rs. } 60 - 58.50 = \text{Rs. } 1.50 \text{ (A)}$

(c) 1. **Mixture Variance** = $M_3 - M_4$

= $\text{Rs. } 213.86 - \text{Rs. } 210.457 = 3.403 \text{ (A)}$

2. **Yield Variance** = $M_3 - M_4$

= $\text{Rs. } 210.457 - \text{Rs. } 194.868 = \text{Rs. } 15.589 \text{ (A)}$

3. **Usage Variance** = $3.403 \text{ (A)} + 15.589 \text{ (A)}$

= $\text{Rs. } 18.992 \text{ (A) (Checked)}$

(d) **Total Variance** = Original Standard Cost — Actual Cost

= $\text{Rs. } 227.368 - \text{Rs. } 268.03 = \text{Rs. } 40.662 \text{ (A)}$

Note. Readers should note 'Planning Variance' and Ingredients Operating Variance. Planning Variance is the difference between an

- (a) You are required to : (i) prepare a **ad analysis sheet** to cover the classifications of :
- (1) production overhead to be absorbed by machine hours.
 - (2) production overhead to be absorbed by direct labour hours.
 - (3) selling and distribution costs.
 - (4) administration costs.
- (ii) calculate the rates of absorption for **each** of the items (1) to (4) above.
- (b) Job 1019, which has been completed and was previously quoted to sell at Rs. 12,000 has had 300 machine hours booked to it and the following costs recorded on the job card :

Raw materials	Rs. 2,888
Direct wages	Rs. 3,500 (for 700 direct labour hours)

You are required to :

- (i) compute the **total cost** of Job 1019, using the rates of **absorption you have calculated for the forthcoming year**, of the show the expected profit and express that profit as a percentage selling price.
- (ii) compare and comment on the percentage profit on Job 1019 with the percentage profit expected overall for the forthcoming year

Solution. (a) (i) Overhead analysis sheet (figures in Rs. '000)

Cost	Production		Direct labour hours	Sales and distribution	Administration
	Total	Machine hours			
Energy and water	20		16	1.0	3.0
Electricity	14	14			
Rent and rates	180		144	9.0	27.0
Repairs—Machinery	25	25			
Buildings	10		8	0.5	1.5
Maintenance of patterns	45		45		
Direct wage related costs	115		115		
Indirect wages	83		83		
Indirect wage related costs	10		10		
Production management salaries	133		133		
Depreciation of machinery	150	150			
Security	10		8	0.5	1.5
Inspection	60		60		
Carriage out	88			88.0	
Salesmen's salaries	100			100.0	

Salesmen's expenses	50			50.0	
Design and estimating	75			75.0	
General management and administration	232				232.0
Advertising	40			40.0	
	<u>1,440</u>	<u>189</u>	<u>622</u>	<u>364.0</u>	<u>265.0</u>
	=====	=====	=====	=====	=====

- (ii) The production overhead related to machinery ought obviously be absorbed on the basis of budgeted machine hours, so the overhead absorption rate will be Rs. $189,000 \div 180,000$ machine hours = Rs. 1.05.

The production overhead not related to the machinery ought to be absorbed by the other method detailed in the question, i.e., direct labour hours, so the rate will be Rs. $622,000 \div 200,000$ direct labour hours = Rs. 3.11.

The budgeted sales value for next year is given as Rs. 45,50,000 and the absorption rate for the selling and distribution costs ought to be based on this figure which gives a figure of 8% (Rs. $3,64,000 \div 45,50,000 \times 100$).

The budgeted sales value could also be used as the basis of the absorption rate for the administration costs and this would give a rate of (Rs. $2,65,000 \div 45,50,000 \times 100 = 5.82\%$).

However, a far better basis would be the budgeted production cost which can be calculated as follows :

Raw materials	Rs. 750
Carriage on raw materials	49
Direct wages	1,040
Overhead—machinery	189
Overhead—based on direct labour hours	622
	<u>2,650</u>
	=====

Therefore Rs. $2,65,000 \div$ Rs. $26,50,000 \times 100 = 10\%$ on production cost.

(b) (i)

Job 1019

Raw materials	Rs. 2,888
Direct wages	3,500
Production overhead :	
300 machine hours \times Rs. 1.05 =	315
700 direct labour hours \times Rs. 3.11 =	2,177
	<u>2,492</u>
Production cost	<u>8,880</u>
Selling and distribution 8% of Rs. 12,000	960
Administration 10% of Rs. 8,880	888
	<u>10,728</u>
	=====

Quoted selling price	12,000
Expected profit	1,272
Expected profit, as percentage of selling price	10.60%
(ii) Expected profit for next year :	Rs. '000
Sales	4,550
Less : Production cost—see (a) (ii) above	2,650
Selling and distribution	364
Administration	265

	3,279
Expected profit	-----
	1,271
Expected profit as a percentage of sales	27.93%

The percentage profit on Job 1019 is only 10.60% of the selling price of Rs. 12,000 whereas the projections for next year are showing a percentage profit of 27.93% on sales of Rs. 45,50,000 which suggests that profits next year will be much better than the current year if the 10.60% is also that earned on most other jobs during the current year. To draw positive conclusions from such a limited comparison can be dangerous.

For question on Pricing and Purchasing Decisions using probability, please refer to Problem 15.20.

For question on coefficient of Multiple correlation/determination, please refer to problem 15.21.

For question on optimisation using LP, please refer to problem 15.22.

Choice of best alternative (Evaluation of Improvement Plans using incremental concept)

Problem 19. A drug treatment day centre run by a charity organisation wishes to improve the quality of its service to patients by the addition of extra facilities.

After much research it has drawn up a 'short list' of five separate possible improvements and has assessed the outcomes using the following criteria :

Criterion A : Reduced average number of waiting hours per month per patient.

Criterion B : Increased percentage frequency of seeing patients when they attend.

Criterion C : Reduced average number of 'months to cure' per patient.

Criterion D : Increased percentage frequency of patient attendance at the centre.

The assessed outcomes are :

Improvement reference number	Extra facilities	Outcome according to criterion			
		A Hours	B %	C Months	D %
1.	Increase medical staff by 2 doctors and 1 nurse	4.8	35	1	5

2.	Increase counselling staff by 2 counsellors and 1 nurse	6	20	1.25	10
3.	Taxi service to bring patients to and from the centre	2	12	0.75	22
4.	Extend by 20 hours per month the time the centre is open	4	30	1.5	10
5.	Introduce group coun- selling sessions	—	10	1.75	15

At present the centre is open for 160 hours per month and deals with 3,000 patients. The proposed improvements will have no effect on the number of patients seen. The professional staff currently employed are 5 doctors, 7 counsellors and 4 nurses.

- The taxi service is expected to be used by 60% of patients with an average attendance of once per month. Each taxi will carry an average of 1.2 patients and the cost to the centre will be Rs. 0.20 per mile. Total distances that patients are expected to be carried per attendance are :

	<i>Percentage of patients</i>
10 miles	20
20 miles	40
30 miles	40
	<hr/> 100 <hr/>

- The costs of extra facilities would be :

	<i>Costs p.a.</i>	<i>Associated capital equipment costs*</i>
Doctor's salary	Rs. 22,000	Rs. 5,000
Doctor's expenses	3,000	—
Counsellor's salary	16,000	2,000
Counsellor's expenses	1,500	—
Nurse's salary	10,000	1,000
Nurse's expenses	2,000	—

*These costs are depreciated over five years on a straight-line basis with no residual value.

Extra administration/establishment costs are Rs. 200 per month per person.

- If hours are extended beyond 160 per month, overtime will need to be paid at a premium of 25% on salaries (but not expenses) and an extra Rs 4,000 per annum will be incurred for administration/establishment costs.

- Group counselling sessions will require :

1 specialist counsellor costing Rs. 3,000 p.a. more than ordinary counsellors*

1 assistant counsellor costing Rs. 2,000 p.a. less than ordinary counsellors*

1 nurse

*Capital costs will be the same as for ordinary counsellors.

The centre's capital requirements will be borrowed from the bank at 12% p.a. The interest and all other costs will be met by donations. The depreciation charge will be used to reduce the loan at the end of each year. Cost of working capital can be ignored.

You are required to :

- (a) calculate for each improvement the incremental cost :
 - (i) per patient per month
 - (ii) for the appropriate unit of each of the four criteria ;
- (b) identify the improvement with the lowest cost in (a) (ii) above for each of the four criteria ;

Solution. 1. (a) Incremental costs

Improvement No. 1	Rs. per annum
Extra 2 doctors—salary and expenses	50,000
Extra 1 nurse—salary and expenses	12,000
Administration costs $3 \times \text{Rs. } 2,400$	7,200
Depreciation 20% of Rs. 11,000*	2,200
Interest on loan for capital equipment 12% of (Rs. 11,000 + Rs. 8,800 + Rs. 6,600 + Rs. 4,400 + Rs. 2,200) $\div 5$	792
	<hr/> 72,192 <hr/>

* $2 \times \text{Rs. } 5,000 + \text{Rs. } 1,000$

Improvement No. 2

Extra 2 counsellors—salary and expenses	35,000
Extra 1 nurse—salary and allowances	12,000
Administration cost $3 \times \text{Rs. } 2,400$	7,200
Depreciation 20% of Rs. 5,000	1,000
Interest on loan for capital equipment 12% of (Rs. 5,000 + Rs. 4,000 + Rs. 3,000 + Rs. 2,000 + Rs. 1,000) $\div 5$	360
	<hr/> 55,560 <hr/>

Improvement No. 3

Taxi service $3,000 \div 1.2$
patients $\times 0.6 \times 12$ months $\times 22$ miles* $\times \text{Rs. } 0.20$
*($10 \times 0.2 + 20 \times 0.4 + 30 \times 0.4$) = 22 miles

79,200

Improvement No. 4

Doctor's salaries ($5 \times \text{Rs. } 22,000$)	Rs. 110,000
Counsellors' salaries ($7 \times \text{Rs. } 16,000$)	112,000
Nurses' salaries ($4 \times \text{Rs. } 10,000$)	40,000
	<hr/>
	$262,000 \times (20 \div 160 \times 1.25)$
	40,938
Extra administration cost	4,000
	<hr/>
	44,938
	<hr/>

Improvement No. 5

1 specialist counsellor—salary and expenses (Rs. 17,500 + Rs. 3,000)	20,500
1 assistant counsellor—salary and expenses (Rs. 17,500 – Rs. 2,000)	15,500
1 nurse—salary and expenses	12,000
Administration cost $3 \times \text{Rs. } 2,400$	7,200
Depreciation 20% of Rs. 5,000 (Rs. $2 \times 2,000$ + Rs. 1,000)	1,000
Interest on loan for capital equipment 12% of (Rs. 5,000 + Rs. 4,000 + Rs. 3,000 + Rs. 2,000 + Rs. 1,000) $\div 5$	360
	<hr/>
	56,560
	<hr/>

(i) Incremental cost per patient per month

No. 1.	Rs. $72,192 \div 36,000$	Rs. 2.01
2.	Rs. $55,560 \div 36,000$	1.54
3.	Rs. $79,200 \div 36,000$	2.20
4.	Rs. $44,938 \div 36,000$	1.25
5.	Rs. $56,560 \div 36,000$	1.57

(ii) Incremental cost for each of the four criteria

No. 1.	A	Rs. $2.01 \div 4.8$	Rs. 0.42
	B	Rs. $72,192 \div (12 \times 35)$	171.89
	C	Rs. $72,192 \div (36,000 \times 1)$	2.01
	D	Rs. $72,192 \div (12 \times 5)$	1,203.20
No. 2.	A	Rs. $1.54 \div 6$	0.26
	B	Rs. $55,560 \div (12 \times 20)$	231.50
	C	Rs. $55,560 \div (36,000 \times 1.25)$	1.23
	D	Rs. $55,560 \div (12 \times 10)$	463.00
No. 3.	A	Rs. $2.20 \div 2$	1.10
	B	Rs. $79,200 \div (12 \times 12)$	550.00
	C	Rs. $79,200 \div (36,000 \times 0.75)$	2.93
	D	Rs. $79,200 \div (12 \times 22)$	300.00

No. 4.	<i>A</i>	$\text{Rs. } 1.25 \div 4$	0.31
	<i>B</i>	$\text{Rs. } 44,938 \div (12 \times 30)$	124.83
	<i>C</i>	$\text{Rs. } 44,938 \div (36,000 \times 1.5)$	0.83
	<i>D</i>	$\text{Rs. } 44,938 \div (12 \times 10)$	374.48
No. 5.	<i>A</i>		
	<i>B</i>	$56,560 \div (12 \times 10)$	471.33
	<i>C</i>	$56,560 \div (36,000 \times 1.75)$	0.90
	<i>D</i>	$56,560 \div (12 \times 15)$	314.22

(b) Improvements with the lowest costs under each criterion*A* Improvement 2*B* Improvement 4*C* Improvement 4*D* Improvement 3

For question on Inter-Division Transfer Pricing—Goal Congruence, please refer to Problem 13.23.

Marketing Decision (Letting out theatre accommodation)

Problem 20. A theatre with some surplus accommodation proposes to extend its catering facilities to provide light meals to its patrons.

The Management Board is prepared to make initial funds available to cover capital costs. It requires that these be repaid over a period of five years at a rate of interest of 14% and discounting factors at this interest rate are indicated below

<i>Year</i>	0	1	2	3	4	5
<i>Discounting Factor</i>	1	0.88	0.77	0.67	0.59	0.52

The capital costs are estimated at Rs. 60,000 for equipment that will have a life of five years and no residual value. Running costs of staff, etc., will be Rs. 20,000 in the first year, increasing by Rs. 2,000 in each subsequent year. The board proposes to charge Rs. 5,000 per annum for lighting, heating and other property expenses and wants a nominal Rs. 2,500 per annum to cover any unforeseen contingencies. Apart from this, the Board is not looking for any profit, as such, from the extension of these facilities, because it believes that this will enable more theatre seats to be sold. It is proposed that costs should be recovered by setting prices for the food at double the direct costs.

It is not expected that the full sales level will be reached until Year 3. The proportions of the level estimated to be reached in Years 1 and 2 are 35% and 65% respectively.

You are required to :

Calculate the sales that need to be achieved in each of the five years to meet the Board's targets.

Ignore taxation and inflation.

Solution. (a) Sales needed by catering facilities at theatre.*Expenditure**(Rs. in thousands)*

<i>Year</i>	<i>Equipment</i>	<i>Staff Expenses</i>	<i>Contingency</i>	<i>Total outgoing</i>	<i>Discount factor</i>	<i>Net present value</i>
0	60			60	1.00	60.00
1		20	5	27.5	0.88	24.20
2		22	5	29.5	0.77	22.72
3		24	5	31.5	0.67	21.11
4		26	5	33.5	0.59	19.77
5		28	5	35.5	0.52	18.46
						166.26
						== =

Income must equate with this net present value over the five years. Assume Re. 1 income per year with reductions in years one and two. Then net present value is :

<i>Year</i>	<i>Rs.</i>	<i>Discount factor</i>	<i>Net present value Rs.</i>
1	0.35*	0.88	0.31
2	0.65*	0.77	0.50
3	1.00	0.67	0.67
4	1.00	0.59	0.59
5	1.00	0.52	0.52
Total			2.59
			— =

* Level of sales

Therefore, annual income needed is Rs. $166.26 \div 2.59 =$ Rs. 64.19 thousands. If profit is 50% then food sales would need to be Rs. 1,28,380.

Sales required :

<i>Year</i>	<i>Rs.</i>
1	(35% of Rs. 1,28,380) 44,930
2	(65% of Rs. 1,28,380) 83,450
3	1,28,380
4	1,28,380
5	1,28,380

C.I.M.A. London November, 1988

For question on Equivalent Production—Average Method, please refer to Problem 6.21 on page P. 6.45.

B.E. Analysis (Utilisation of spare capacity by reducing price).

Problem 21. A summary of a manufacturing company's budgeted profit statement for its next financial year, when it expects to be operating at 75 per cent of capacity is given below.

Sales	9,000 units at Rs. 32		Rs. 2,88,000
Less :	Direct materials	Rs. 54,000	
	Direct wages	72,000	
	Production overhead :		
	—fixed	42,000	
	—variable	18,000	
		<hr/>	1,86,000
	Gross profit		<hr/> 1,02,000
Less :	Administration, selling and distribution costs :		
	—fixed	36,000	
	—varying with sales volume	27,000	
		<hr/>	63,000
	Net profit		<hr/> 39,000

You are required to :

(a) calculate the breakeven point in units and in value.

(b) It has been estimated that :

- (i) if the selling price per unit were reduced to Rs. 28, the increased demand would utilise 90% of the company's capacity without any additional advertising expenditure, and
- (ii) to attract sufficient demand to utilise full capacity would require a 15% reduction in the current selling price and a Rs. 5,000 special advertising campaign

You are required to present a statement showing the effect of the two alternatives compared with the original budget and to advise management which of the three possible plans ought to be adopted, i.e. the original budget plan or (i) above or (ii) above.

(c) An independent market research study shows that by spending Rs. 15,000 on a special advertising campaign, the company could operate at full capacity and maintain the selling price at Rs. 32 per unit.

You are required to : (i) Advise management whether this proposal should be adopted, and

(ii) State any reservations you might have.

Solution. (a)

	Total	Per Unit
Sales (9,000 units*)	Rs. 2,88,000	Rs. 32
Less : Variable Costs		
Direct Materials	54,000	6
Direct wages	72,000	8
Production overheads	18,000	2
Admin.. S & D OH.	27,000	3
	<hr/>	<hr/>
	1,71,000	19
Contribution	<hr/> 1,17,000	<hr/> 13

Less Fixed Overheads :

Production	42,000	
Admn., S & D	36,000	
	<u> </u>	78,000
		<u> </u>
		39,000
		<u> </u>

* Capacity utilization 75%

$$P/V \text{ Ratio} = (S - V)/S \times 100 = 40.625\%$$

$$BE \text{ Sales} = \text{Fixed cost} \div P/V \text{ Ratio}$$

$$= 78,000 \div 40.625\% = \text{Rs. } 192,000$$

$$\text{or Rs. } 192,000 \div \text{Rs. } 32 = 6,000 \text{ units}$$

	(i)	(ii)
(b) Production	90% Capacity (10,800 units)	100% Capacity (12,000 units)
Selling Price per unit	Rs. 28	Rs. 27.20
Variable Cost per unit	19	19.00
	<u> </u>	<u> </u>
Contribution per unit	9	8.20
	<u> </u>	<u> </u>
P/V Ratio	31.143%	30.147%
Total Contribution	97,200	98,400
Less Fixed Overheads	78,000	83,000
	<u> </u>	<u> </u>
	19,200	15,400
	<u> </u>	<u> </u>

The P/V Ratio has come down to 31.143% in the case of alternative (i) and 30.147% in the case of alternative b (ii). Therefore, company should follow original plan as at (a) above.

(c) (i) Selling price per unit	Rs. 32
Less : Variable costs	19
	<u> </u>
Contribution per unit	13
	<u> </u>
Total Contribution (12,000 × Rs. 13)	1,56,000
Less fixed cost	93,000
	<u> </u>
Profit	63,000
	<u> </u>

This proposal should be accepted as there is a considerable increase in profit.

(ii) The report of the market research group should be thoroughly scrutinised and how far past predictions have come true. It is, therefore, necessary to apply probability theory to the findings of market study group.

B.E. Analysis (Fixing room charges of a leisure centre)

Problem 22 : A local government authority owns and operates a leisure centre with numerous sporting facilities, residential accommodation, a cafeteria and a sports shop. The summer season lasts for 20 weeks including a peak period of 6 weeks corresponding to the school holidays. The following budgets have been prepared for the next summer season :

Accommodation

60 single rooms let on a daily basis.

35 double rooms let on a daily basis at 160% of the single room rate.

Fixed costs Rs. 29,960.

Variable costs Rs. 4 per single room per day and Rs. 6.40 per double room per day.

Sports Centre

Residential guests each pay Rs. 2 per day and casual visitors Rs. 3 per day for the use of facilities.

Fixed costs Rs. 15,500.

Sports Shop

Estimated contribution Re. 1 per person per day.

Fixed costs Rs. 8,250.

Cafeteria

Estimated contribution Rs. 1.50 per person per day.

Fixed costs Rs. 12,750.

During the summer season the centre is open 7 days a week and the following activity levels are anticipated.

Double rooms fully booked for the whole season.

Single rooms fully booked for the peak period but at only 80% of capacity during the rest of the season.

30 casual visitors per day on average.

You are required to :

- (a) Calculate the charges for single and double rooms assuming that the authority wishes to make a Rs. 10,000 profit on accommodation ;
- (b) Calculate the anticipated total profit for the leisure centre as a whole for the season ;
- (c) Advise the authority whether an offer of Rs. 2,50,000 from a private leisure company to operate the centre for five years is worthwhile, assuming that the authority uses a 10% cost of capital and operations continue as outlined above.

Solution. (a) We know that $S - V = F + P$ or $S = F + P + V$
Fixed cost and profit are given. Now find out variable cost.

Room-days usage

Single = 60 rooms \times 6 weeks \times 7 days = 2,520 *Variable cost*
 60 rooms \times 14 weeks \times 7 days \times 80% = 4,704

7,224 \times Rs. 4
 = Rs. 28,896

Double-35 rooms \times 20 \times 7 = 4,900 \times Rs. 6.40 = 31,360

Total variable cost = Rs. 60,256

Let x be charge per day for single room

Equation will be : $S = F + P + V$

By putting the values :

$2,520x + 4,704x + 4,900 \times 1.6x = \text{Rs. } 28,896 + \text{Rs. } 10,000 + \text{Rs. } 60,256$
 $15,064x = \text{Rs. } 1,00,156$ or $x = \text{Rs. } 6.65$

Charge for double room = Rs. 6.65 \times 1.6 = Rs. 10.64

(b) Profit from accommodation Rs. 10,000 (a)

Profit from Sports Centre :

Realisation : Residential guests

= $7,224 + (4,900 \times 2) = 17,024 \times \text{Rs. } 2 = \text{Rs. } 34,048$

Casual visitors

= $30 \times 20 \text{ weeks} \times 7 \text{ days} \times \text{Rs. } 3 = \text{Rs. } 12,600$

Rs. 46,648

Less : fixed costs

15,500

Profit

Rs. 31,148 (b)

Contribution from Sports Shop

$7,224 + (4,900 \times 2) + 4,200^* = 21,225 \times 1$ 21,224

Less : Fixed cost

8,250

Profit

Rs. 12,974 (c)

Contribution for Cafeteria

$7,224 + (4,900 \times 2) + 4,200$

= $21,224 \times 1.5$

Rs. 31,836

Less : Fixed Cost

12,750

Profit

19,086 (d)

Total Profit (a) + (b) + (c) + (d)

Rs. 73,208

(c) As per (b) above the estimated profit or cash flow is Rs. 73,208 p.a. The present value of this amount for 5 years at 10% cost of capital = Rs. $73,208 \times 3.79 = \text{Rs. } 2,77,548$. But the private leisure company is only offering Rs. 2,50,000 and as such offer should be rejected.

* Casual

For question on Replacement of existing machine by use of t-distribution, please refer to Problem 15.19 of chapter 15.

Quoting for special order (Overtime working vs. Sub-contracting)

***Problem 23.** A company has to quote for a special order to be made in its two departments R and S. Details are as follows :

	Department R	Department S
Standard direct wage rate (per hour)	Rs. 5	Rs. 3
Standard variable overhead (per hour)	2.50	2
Standard fixed overhead (per hour)	6	4
Direct labour hours per unit (for first 100 units)	12	5
Direct labour hours available (per period)	4,000	3,000
Expected rate of learning curve (applied per block of 100 units)	80%	70%

Cost of direct materials used in department R :

Level of output	Cost per unit of output
100	Rs. 36.00
200	32.40
800	27.00

No overtime premium has been included in the calculation of overhead but, when necessary, overtime is paid at time and a half.

The special order involves special tooling to be used in department R at a total cost of Rs. 600, chargeable to the customer.

In arriving at selling prices, the company adds profit margins of :

- 25% of total cost in department R
- 15% of total cost in department S
- 5% of total cost on any sub-contractor's work.

No profit margins are added to direct materials or to special tooling.

If the order is for 200 units or fewer, tooling need to be done during period 5 which already has a work load of

Department R	2,560 direct labour hours
Department S	1,400 direct labour hours

For this order a sub-contractor has quoted Rs 16 per unit for the work that would be done by department S.

Because of the sub-contractor's abnormally keen price and the fact that department S has been operating at normal levels the company is wondering whether it should close department S and have the sub-contractor do the work that department S normally does.

You are required :

- (a) to recommend the price to be charged for units made entirely within the company for an order of : (i) 100 units (ii) 200 units
- (b) assuming an order for 200 units has been placed as in (a) (ii) above, to recommend the lowest price the company could charge for an additional order of 600 units in the following conditions :

- (i) the company wished to treat this as an incremental order but did not wish to make a loss on it, and
- (ii) the additional work would be done when there were no capacity constraints for either department, and
- (iii) the materials supplier would charge the price at the 800 level;
- (c) to recommend in what circumstances
- (i) the sub-contractor should be used for this order,
- (ii) you would agree to the idea of closing department S and having its work done by the sub-contractor.

Solution. Workings

	Department R		Department S
Normal labour hours available	4,000		3,000
Existing work load	2,560		1,400
Special order (100 units) 100×12	1,200	100×6	600
Total	3,760		2,000
Special order (200 units)			
$200 \times 12 \times 80\%$	1,920	$200 \times 6 \times 70\%$	840
less for 100 order	1,200	720	
		less 100 order 600	240
Total	4,480		2,240

Overtime hours :

$$480 \times \text{Rs. } 5 \times 50\% = \text{Rs. } 1,200$$

$$\text{Rs. } 1,200 \div 200 = \text{Rs. } 6 \text{ per unit overtime premium}$$

(a) Cost statement

(a) Cost statement	(i) 100 units		(ii) 200 units	
Department R				
Direct labour	12 × Rs. 5	60	at 80%	Rs. 48.0
Variable overhead	12 × Rs. 2.50	30	at 80%	24.0
Fixed overhead	12 × Rs. 6	72	9.6 × Rs. 6	57.6
Overtime premium		—		6.0
Department S				
Direct labour	6 × Rs. 3	18	at 70%	12.6
Variable overhead	6 × Rs. 2	12	at 70%	8.4
Fixed overhead	6 × Rs. 4	24	4.2 × Rs. 4	16.8
Overtime premium		—		—
Direct material		36	at 90%	32.4
Special tools	Rs. 600 ÷ 100	6	at 50%	3.0
Total cost		258.0		208.8

Profit :

Department R	25% of Rs. 162	40.5	of Rs. 135.6	33.90
Department S	15% of Rs. 54	8.1	of Rs. 37.8	5.67
Cost per unit		<u>Rs. 306.6</u>		<u>Rs. 248.37</u>

Recommended price :

(i) 100 units at Rs. 306.60 each

(ii) 200 units at Rs. 248.37 each

(b) Order for 600 units incremental to, but combined with, the order for 200 units making 800 units in all.

Note : No capacity restraints, fixed overheads already recovered and no profit on the 600 units.

	200 units as (a) (ii)		800 units
Department R	Rs.		Rs.
Direct labour	48.0	} Rs. $72 \times 0.8 \times 0.8$	46.08
Variable overhead	24.0		
Department S			
Direct labour	12.6	} Rs. $21 \times 0.7 \times 0.7$	10.29
Variable overhead	8.4		
Direct material	32.4	$\times 75 \div 90$	27.00
	<u>Rs. 125.4</u>		<u>Rs. 83.37</u>

Cost of 800 units as above at Rs. 83.37 Rs. 66,696

Cost of 200 units as above at Rs. 125.4 25,080

Therefore 600 units

Rs. 41,616 (AverageRs. 69.36 each)

An incremental order for 600 units with no capacity restrictions, fixed overhead already recovered and no profit could be charged at Rs. 69.36 each or Rs. 41,616 for the 600 units.

(c) (i) When the sub-contractor should be used for this order instead of Department S

	Rs. per unit
: Sub-contractor's price	<u>16</u>
Department S Variable cost	
Direct labour	6 × Rs. 3 18
Variable overhead	6 × Rs. 2 12
	<u>30</u>

Solution. (a) Standard product cost for one unit.

Direct material ($10 \times \text{Rs. } 20$)	= Rs. 200
Direct wages, ($12 \times \text{Rs. } 5.50$)	= 66
Production overhead $9,00,000 \div 60,000 \times 12\text{hr.}$	= 180
Total Standard Cost	<u>446</u>

(b) Calculations showing Material Cost Variances

M_1 —Actual cost of material used	= Rs. 10,50,000
M_2 —Standard cost of material used ($1,00,000 \text{ kg} \times \text{Rs. } 10$)	= 10,00,000
M_3 —Not relevant, there is no mix variance	
M_4 —Standard material cost of output ($20' \text{ kg} \times \text{Rs. } 10 \times 4800 \text{ units}$)	= 9,60,000
Material Price Variance = $M_1 - M_2$	= Rs. 10,50,000 — Rs. 10,00,000 = Rs. 50,000 (A)
Material Usage Variance = $M_2 - M_4$	= Rs. 10,00,000 — Rs. 9,60,000 = Rs. 40,000 (A)
Material Cost Variance = Rs. 50,000 (A) + Rs. 40,000 (A)	= Rs. 90,000 (A)
Alternatively, $M_1 - M_4$	= Rs. 10,50,000 — Rs. 9,60,000 = Rs. 90,000 (A)

For Direct Wage Variance

L_1 —Actual payment made for actual hours worked	= Rs. 3,10,000
L_2 —Payment involved, if the worker had been paid at standard rate ($62,000 \times \text{Rs. } 5.50$)	= Rs. 3,41,000
L_3 —Not appropriate as there is no gang variance	
L_4 —Standard labour cost of hours utilised ($60,000 \text{ hrs} \times \text{Rs. } 5.50$)	= Rs. 3,30,000
L_5 —Standard labour cost of output achieved ($12 \text{ hrs} \times \text{Rs. } 5.50 \times 4800 \text{ units}$)	= 3,16,800
Wage Rate Variance = $L_1 - L_2$	= Rs. 3,10,000 — Rs. 3,41,000 = Rs. 31,000 (F)
Wage Idle Time Variance = $L_2 - L_4$	= Rs. 3,41,000 — Rs. 3,30,000 = Rs. 11,000 (A)
Wage Fixed Variance = $L_4 - L_5$	= Rs. 3,30,000 — Rs. 3,16,800 = Rs. 13,200 (A)
Wage Efficiency Variance = $L_2 - L_5$	= Rs. 3,41,000 — Rs. 3,16,800 = Rs. 24,200 (A)
Wage Cost Variance = $L_1 - L_5$	= Rs. 3,10,000 — Rs. 3,16,800 = Rs. 6,800 (F)

Production Overhead Variance

FO_1 —Fixed Overhead incurred	= Rs. 9,26,000
FO_2 —Budgeted Fixed Overhead for the period	= Rs. 9,00,000

FO_3 —Fixed Overhead for hours

available at standard rate during the period.

$(Rs. 9,00,000 \div 60,000 \text{ hrs.}) \times 62,000 \text{ hrs.} = Rs. 9,30,000$

FO_4 —Fixed Overhead for actual hours worked at standard rate

$(Rs. 9,00,000 \div 60,000 \text{ hrs.}) \times 60,000 \text{ hrs.} = Rs. 9,00,000$

FO_5 —Standard Fixed Overhead for production = Rs. 8,64,000

12 hrs \times Rs. 15 \times 4800 units.

Fixed Overhead Expenditure Variance = $FO_1 - FO_3$

= Rs. 9,26,000 — Rs. 9,00,000 = Rs. 26,000 (A)

Fixed Overhead Idle Time Variance = $FO_3 - FO_2$

= Rs. 9,00,000 — Rs. 9,30,000 = Rs. 30,000 (F)

Fixed Overhead Capacity Variance = $FO_3 - FO_4$

= Rs. 9,30,000 — Rs. 9,00,000 = Rs. 30,000 (A)

Fixed O.H. Efficiency Variance = $FO_4 - FO_5$

= Rs. 9,00,000 — Rs. 8,64,000 = Rs. 36,000 (A)

Fixed Overhead Volume Variance = $FO_2 - FO_5$

= Rs. 9,00,000 — Rs. 8,64,000 = Rs. 36,000 (A)

Fixed Overhead Variance = $FO_1 - FO_5$

= Rs. 9,26,000 — Rs. 8,64,000 = Rs. 62,000 (A)

Alternatively, FO Price Variance + F.O. Volume Variance

= Rs. 26,000 (A) + Rs. 36,000 (A) = Rs. 62,000 (A)

(c) Reconciliation Statement

Standard Cost :

Direct Materials	4800 units \times Rs. 200	= Rs. 9,60,000
Labour	4800 units \times Rs. 66	= 3,16,800
Production Overhead	4800 units \times Rs. 180	= 8,64,000
		<hr/>
		21,40,800

Variance :

Direct Material : Price	Rs. 50,000 (A)	
Usage	40,000 (A)	
Total	<hr/>	90,000 (A)
Labour		
Rate	Rs. 31,000 (F)	
Efficiency	Rs. 24,200 (A)	
Total	<hr/>	6,800 (F)
Overhead		
Expenditure	Rs. 26,000 (A)	
Volume	36,000 (A)	
Total	<hr/>	62,000 (A)
Actual Cost		<hr/>
		Rs. 22,86,600
		<hr/>

Verification

Actual Cost : Direct Material	=Rs. 10,50,000
Direct Wages	=Rs. 3,10,000
Production Overhead	=Rs. 9,26,000
Total	<u>22,86,000</u>

I.C.W.A. Inter June 1988

For question on Cost sheet—Working out actual and estimated profit with no W.I.P., please refer to Problem 5·8 on page P. 5·12

For question on Valuation of Materials—Weighted Average Method, please refer to Problem 1·23 on page P. 1·32

For question on EOQ and Total Annual Inventory Cost, please refer to Problem 1·10 on page P. 1·8.

Remuneration and Incentives (Piece-work Premium)

Problem 25. Two fitters, a labourer and a boy undertake a job on piece rate basis for Rs. 1,290. The time spent by each of them is 220 ordinary working hours. The rates of pay on time-rate basis are Rs. 1·50 per hour for each of the two fitters, Re. 1 per hour for the labourer and Re. 0·50 per hour for the boy. Calculate :

- The amount of piece-work premium and the share of each worker, when the piece-work premium is divided proportionately to the wages paid.
- The selling price of the above job on the basis of the following additional data :

Cost of Direct Material Rs. 2,010, Works Overhead at 20% of Prime Cost, Selling Overhead at 10% of Works Cost and Profit at 25% on Cost of Sales.

Solution**(a) Calculation of Wages**

	Rs.
2 fitters at Rs. 1·50 per hour for 220 hours each	=660
1 labourer at Re. 1·00 per hour for 220 hours	=220
1 boy at Re 0·50 per hour for 220 hours	=110
Total	<u>990</u>

Piece-work Premium

Total wages agreed on piece rate	=Rs. 1,290
Less : wages calculated on time basis	= 990
	<u>300</u>

Amount of premium will be paid to workers in proportion to the wages paid, i.e., Fitter : Labourer : Boy = 660 : 220 : 110 as under

2 Fitters	Rs. 200 00
1 Labourer	66 67
1 Boy	33 33
	<hr/>
	300 00
	<hr/>

(b) Calculation of selling Price

Cost of direct materials	=Rs. 2,010
Direct Wages {as given in (a)}	= 1,290
	<hr/>
Prime Cost	3,300
Works Overhead at 20% of Prime cost	= 660
	<hr/>
Works Cost	3,960
Selling Expense 10% of Works Cost	396
	<hr/>
Cost of Sales	4,356
Add : Profit 25% on Cost of Sales	1,089
	<hr/>
	5,445
	<hr/>

Control Accounts (Preparation of Missing Values, Cost Ledger Accounts when reconciliation statement is given)

Problem 26. The profit and loss account as shown in the financial books of a company for the year ended 30-9-89 together with a statement of reconciliation between the profit as per financial and cost accounts is given below :

Profit and Loss Account for the year ended 30 9-89.

	Rs.	Rs.		Rs.	Rs.
<i>Opening stock</i>			<i>Sales</i>		15,00,000
Raw Material	90,000		<i>Closing stock</i>		
Work-in-progress	50,000		Raw material	98,000	
Finished Goods	70,000		Work-in-progress	53,000	
	<hr/>		Finished goods	72,000	
	2,10,000			<hr/>	2,23,000
Raw Material Purchases	5,00,000		Miscellaneous receipts		45,000
Direct wages	2,00,000				
Factory overheads	2,00,000				
Administration expense	1,70,000				
Selling & Distribution expense	2,20,000				
Preliminary expenses written off	75,000				
Debiture Interest	30,000				
Net Profit	1,63,000				
	<hr/>				<hr/>
	17,68,000				17,68,000
	<hr/>				<hr/>

* Understatement of opening stock contributes to increase in profit and *vice versa*. Similarly understatement of closing stock contributes to reduction in profit and *vice versa*.

(i) Raw Materials A/c			
To Opening Stock	Rs. 91,650	By W.I.P. A/c	Rs. 4,92,450
„ Purchases	5,00,000	(Balancing figure)	
		By Closing Stock	99,200
	<u>5,91,650</u>		<u>99,200</u>
	=====		=====

(ii) W.I.P. Control A/c			
To Opening Stock	Rs. 48,700	By Cost of Sales A/c	8,88,900
„ Raw Material	4,92,450	(Balancing figure)	
„ Direct Wages	2,00,000	By Closing Stock	52,250
„ F.O. A/c	2,00,000		
	<u>9,41,150</u>		<u>52,250</u>
	=====		=====

(iii) Finished Goods Control A/c			
To Opening Stock	Rs. 68,000	By Cost of Sales A/c	10,53,900
„ W.I.P. Control A/c	8,88,900	(Balancing figure)	
„ Admn. O.H.	1,70,000	By Closing Stock	73,000
	<u>11,26,900</u>		<u>73,000</u>
	=====		=====

(iv) Cost of Sales A/c			
To Finished Goods		By Costing P & L	
A/c	Rs. 10,53,900	A/c	12,73,900
„ Selling & Distribution Exp.	2,20,000		
	<u>12,73,900</u>		<u>12,73,900</u>
	=====		=====

(v) Costing Profit & Loss A/c			
To Cost of Sales		By Sales	Rs. 15,00,000
A/c	Rs. 12,73,900		
„ Profit	2,26,100		
	<u>15,00,000</u>		<u>15,00,000</u>
	=====		=====

Break-Even Analysis (Evaluation of Profit Plans)

Problem 27: C Company prepares a cost-volume-profit budget analysis for each plant as per details below :

(a) Profit plan for Plant 1 shows annual budgeted fixed costs Rs. 12,00,000 ; variable costs Rs. 8,40,000 ; and sales value of production Rs. 22,00,000. Allocated head office budgeted fixed costs are Rs. 3,20,000. You are asked to prepare an analysis indicating the break-even points before and after cost allocation. Explain why the break-even points change (in Rs.) is greater than the allocated amount.

(b) Plant 2 produces a product that sells at Rs. 40. It costs Rs. 42.50 when 15,000 units are produced. At a production level of 20,000, the cost per unit is Rs. 38.125. What is the break-even point in Rs. and in units ?

(c) Plant 3—budgeted income and cost estimates are as follows :

Sales (annual)	Rs. 10,00,000
----------------	---------------

Costs :

Fixed	Rs. 4,00,000	
Variable	Rs. 3,00,000	
Head office expenses allocated	Rs. 3,50,000	
	<u>Rs. 10,50,000</u>	

Loss	<u>50,000</u>
------	---------------

Sale of Plant 3 is under consideration. What is your recommendation based on the data given ? Justify your recommendation.

(d) Plant 4 produces one product : The budgeted income and cost estimates are as follows :

Sales (annual) @ Rs. 200 per unit	Rs. 20,00,000
-----------------------------------	---------------

Cost :

Fixed	Rs. 7,47,500	
Variable	Rs. 13,50,000	
Headoffice exp. allocated	Rs. 5,02,500	
	<u>Rs. 26,00,000</u>	

Loss	<u>Rs. 6,00,000</u>
------	---------------------

How many additional units must be manufactured in the Plant in order to break-even ? What would be the profit pickup per unit above break-even ?

Solution.

(a) Sales Value	=	Rs. 22,00,000
Variable Cost	=	8,40,000
Contribution		<u>13,60,000</u>

P/V ratio = $\frac{13,60,000}{22,00,000} \times 100 = 61.82\%$

Break-even Point before allocation

$$\text{BES} \times \text{P/V ratio} = \text{Fixed Cost}$$

$$\text{BES} \times 61.82\% = \text{Rs. } 12,00,000 = \text{Rs. } 19,41,119$$

Break-even Point after allocation

$$\text{BES} \times \text{P/V ratio} = \text{Fixed Cost including allocated expenses}$$

$$\text{or } \text{BES} \times 61.82\% = \text{Rs. } 12,00,000 + \text{Rs. } 3,20,000 = \text{Rs. } 24,58,751$$

$$(b) \text{ Cost for 20,000 units} = 20,000 \times 38.125 = \text{Rs. } 7,62,500$$

$$\text{Less : Cost for 15,000 units} = 15,000 \times 42.50 = 6,37,500$$

5,000 units	1,25,000
=====	=====

$$\text{Variable Cost per unit} = \text{Change in Cost} \div \text{Change in quantities}$$

$$= \text{Rs. } 1,25,000 \div 5,000 \text{ units} = \text{Rs. } 25$$

$$\therefore \text{ Variable Cost for 15,000 units} = 15,000 \times 25 = \text{Rs. } 3,75,000$$

$$\therefore \text{ Fixed Cost} = \text{Total Cost at level of 15,000 units}$$

$$= \text{Rs. } 6,37,500 - \text{Rs. } 3,75,000 = \text{Rs. } 2,62,500$$

$$\text{Break-even Point} \times \text{P/V ratio} = \text{Fixed Cost}$$

$$\text{BEP} \times \{(40 - 25) \div 40\} = \text{Rs. } 2,62,500 \text{ or } \text{BES} = \text{Rs. } 7,00,000$$

$$\text{BEP in units} = \text{Rs. } 7,00,000 \div \text{Rs. } 40 = 17,500 \text{ units}$$

$$(c) \text{ P/V ratio of Plant 3} = \{(\text{Rs. } 10,00,000 - \text{Rs. } 3,00,000) \div 10,00,000\}$$

$$= 70\%$$

$$\text{Fixed Cost of Plant 3} = \text{Rs. } 4,00,000$$

$$\text{Break-even Sales of Plant 3} = \text{Rs. } 4,00,000 \div 70\%$$

$$\text{or BES} = \text{Rs. } 5,71,429$$

The plant is operating above the break-even point and it is yielding contribution to absorb head office expenses. Therefore, this plant should not be closed down, because head office expenses will be there in any case. Decision to close plant A will lead to a loss of contribution of Rs. 7,00,000.

$$(d) \text{ Sales of Plant 4} = \text{Rs. } 20,00,000$$

$$\text{Variable Cost} = 13,50,000$$

Contribution	6,50,000
=====	=====

$$\text{B.E.P.} \times \text{P/V ratio} = \text{Rs. } 7,47,500$$

$$\text{BES} = 7,47,500 \div (6,50,000 \div 20,00,000) = \text{Rs. } 23,00,000 = 11,500 \text{ units}$$

$$\text{Additional units required to break even}$$

$$= 11,500 - 10,000 = 1,500 \text{ units}$$

$$\text{Profit pickup will be equal to contribution per unit}$$

$$= \text{Rs. } 6,50,000 \div 10,000 \text{ units} = \text{Rs. } 65 \text{ per unit}$$

Overhead Absorption

Problem 28. Carter Manufacturing Co. produces two products X and Y. The manufacturing division consists of two producing (designa-

ted 1 and 2) and two service (designated 3 and 4) departments. The company uses a historical (absorption) costing system, except that predetermined (budgeted) overhead rates are in the producing departments to absorb factory overhead to the products. The rate for dept. 1 is based on direct machine hours (DMH) and the rate for dept. 2 is based on direct labour hours (DLH). In applying overhead during the year, the predetermined rates are multiplied by actual hours. The following budget and actual data are available :

1. Annual profit plan data :

- (a) Factory Overhead budgeted for the year Dept. 1 Rs. 8,50,000 ; Dept. 2 Rs. 7,25,000 ; Dept 3 Rs. 2,00,000 ; Dept. 4 Rs. 1,50,000. Machine operators salaries are treated as overhead cost.
- (b) Budgeted units to be produced : Product X 50,000 ; Y 30,000.
- (c) Budgeted raw material cost per unit of product (all used in Dept.) Product X Rs. 40 ; Product Y Rs. 50. No material is added in Dept. 2.
- (d) Budgeted time required for production : Direct machine hours in Dept 1 for each unit of finished goods—Product X-1½, Product Y-1.

Direct labour hours in Dept. 2 for each unit of finished goods—Product X 2 hrs. ; Product Y 2½ hrs.

- (e) Average wage rates budgeted in Dept. 2 ; Product X Rs. 24/hr and Product Y Rs. 25/ hr.
- (f) Allocation of Service Dept. cost to producing depts :
Dept 3 allocates $\frac{1}{2}$ to Dept 1 and $\frac{1}{2}$ to Dept 2.
Dept 4 allocates $\frac{2}{3}$ to Dept 1 and $\frac{1}{3}$ to Dept 2.

2. January actual data :

- (a) Units actually produced in January—Product X 4,000 ; Y 3,000.
- (b) Actual direct machine hours in Dept 1—product X 6100 ; Product Y 4150.
- (c) Actual Costs incurred :

Dept.	Overhead	Raw material	Direct Hours	Labour Cost
1.	Rs. 77,000 X Y	Rs. 1,63,000 Rs. 1,52,000		
2.	Rs. 68,000		X 8,200 Y 7,400	Rs. 1,97,300 Rs. 1,84,000
3.	Rs. 20,000			
4.	Rs. 16,000			

Required : (a) Compute the predetermined overhead rate for each producing dept. Show your computations.

- (b) Prepare a performance report for January, that will reflect budgeted cost and actual cost.

Suggested Approach. Products X and Y are produced in four departments 1, 2, 3 and 4. Depts. 3 and 4 are service departments. Cost of Department 1 is distributed based on machine hours and cost of department 2 is distributed based on labour hours. Budgeted total cost and actual cost is to be determined.

Solution. (a) **Computation of predetermined overhead rate, for each production department.**

(i) *Calculation showing the Cost of each production Deptt.*

	<i>Production Department</i>		<i>Service Department</i>	
	<i>Deptt. 1</i>	<i>Deptt. 2</i>	<i>Deptt. 3</i>	<i>Deptt. 4</i>
Factory O.H. budgeted for the year	Rs. 8,50,000	Rs. 7,25,000	Rs. 2,00,000	Rs. 1,50,000
Allocation of Cost of Service Deptt. 3 to production Deptt. in ratio of 50 : 50 ;	1,00,000	1,00,000	(—) 2,00,000	
Allocation of cost of Service Deptt. 4 to production Deptt in given ratio i.e. $\frac{2}{3} : \frac{1}{3}$	1,00,000	50,000		(—) 1,50,000
	<u>10,50,000</u>	<u>8,75,000</u>		

(ii) **Machine hours/labour hours for Production Departments**

<i>No. of Machine hrs. in Deptt. 1</i>		
<i>Production</i>	<i>Direct Machine Hours in Deptt. 1</i>	<i>Total No. of Mach. hrs.</i>
X 50,000 units	1½ hrs. per unit	75,000 hrs.
Y 30,000 units	1 hr. per unit	30,000 hrs.
		<u>1,05,000 hrs.</u>
<i>No. of Labour hours in Deptt. 2</i>		
<i>Production</i>	<i>Direct Labour hours in Deptt. 2.</i>	<i>Total No. of Labour hours</i>
X 50,000 units	2 hrs. per unit	1,00,000
Y 30,000 units	2.5 hrs. per unit	75,000
		<u>1,75,000</u>

(b) Performance Report.

	Budget Rs.		Production X=4,000 units; Y=3,000 units
Raw Material			<i>Actual</i>
X	$4,000 \times 40 = 1,60,000$		Rs.
Y	$3,000 \times 50 = 1,50,000$		1,63,000
Labour Deptt. 1			1,52,000
X	$4,000 \times 2 \text{ hrs.} \times \text{Rs. } 24 = 1,92,000$		8,200 hrs. \times Rs. 24.061 = 1,97,300
Y	$3,000 \times 2\frac{1}{2} \text{ hrs.} \times \text{Rs. } 25 = 1,87,500$		7,400 hrs. \times Rs. 24.865 = 1,84,000
Overhead Deptt. 1			
X	$4,000 \times 1\frac{1}{2} \text{ hrs.} \times 10 = 60,000$		6,100 hrs. \times Rs. 9.53* = 58,133
Y	$3,000 \times 1 \text{ hrs.} \times 10 = 30,000$		4,150 hrs. \times Rs. 9.53 = 39,550
Deptt. 2			
X	$4,000 \times 2 \text{ hrs.} \times \text{Rs. } 5 = 40,000$		8,200 hrs. \times Rs. 5.34* = 43,788
Y	$3,000 \times 2.5 \text{ hrs.} \times \text{Rs. } 5 = 37,500$		7,400 hrs. \times Rs. 5.34 = 39,516
	Total Budgeted Cost		Total Actual Cost
	8,57,500		8,77,287

* Actual hourly rate has been worked out as follows :

	Deptt. 1	Deptt. 2	Deptt. 3	Deptt. 4
Actual Overhead	Rs. 77,000	Rs. 68,000	Rs. 20,000	Rs. 16,000
Allocation of Cost of :				
Deptt. 3	+	10,000	+	
Deptt. 4.	+	10,667	(-) 20,000	(-) 16,000
Total		<u>97,667</u>		
		<u>==</u>		

Machine Hours

in Deptt. 1	
X	— 6,100 hrs.
Y	— 4,150 hrs.
	<u>10,250 hrs.</u>

Labour hours in Department 2 =

X	— 8,200 hrs.
Y	— 7,400 hrs.
	<u>15,600 hrs.</u>
	<u>==</u>

Actual Machine hours rate of Deptt. 1 = $\text{Rs. } 97,667 \div 10,250 \text{ hrs.} = \text{Rs. } 9.53 \text{ per machine hour.}$

Actual Labour hour rate of Deptt. 2 = $\text{Rs. } 83,333 \div 15,600 \text{ hrs.} = \text{Rs. } 5.34 \text{ per labour hour.}$

\therefore Machine hours rate of Deptt. 1 = $\frac{\text{Total Cost of Deptt. 1}}{\text{Total No. of machine hours}}$
 $= \text{Rs. } 10,50,000 \div 1,05,000 \text{ hrs} = \text{Rs. } 10 \text{ per machine hour}$
 Labour hour rate of Deptt. 2 = $\frac{\text{Total Cost of Deptt. 2}}{\text{Total No. of labour hours}}$
 $= \text{Rs. } 8,75,000 \div 1,75,000 \text{ labour hours} = \text{Rs. } 5 \text{ per labour hour}$

● **Functional Budget (Determination of Working Capital Requirement).**

Problem 29. From the following information you are required to estimate the net working capital :

	<i>Cost per unit</i>
Raw material	Rs. 800
Direct Labour	300
Overheads (excluding Depreciation)	600

Total Cost	1,700
Selling price	2,000
	=====

Output 52,000 units per annum at an even pace

Raw Material in Stock Average 4 weeks

Work-in-progress (whole of materials and 50% completion stage for labour and overhead)

Average 2 weeks

Finished goods in stock " 4 weeks

Credit allowed to debtors " 8 weeks

Credit allowed by suppliers " 4 weeks

All sales are on credit basis and materials are introduced at the commencement of the process.

Solution. Determination of Working Capital Requirements

1. *Raw materials*

52,000 units \div 52 weeks \times Rs. 800 \times 4 weeks = Rs. 32,00,000

2. *Work-in-Progress*

(a) *Raw Material*

52,000 units \div 52 weeks \times Rs. 800 \times 2 weeks
Rs. 16,00,000

(b) *Labour and Overheads*

$\frac{1}{2}$ [52,000 \div 52 weeks \times (Rs. 300 + Rs. 600) \times 2 weeks]
= 9,00,000

----- 25,00,000

3. *Finished Goods*

52,000 units \div 52 weeks \times
(Rs. 800 + Rs. 300 + Rs. 600) \times 4 weeks = 68,00,000

4. *Credit allowed to Debtors*

52,000 units \div 52 weeks
 \times (800 + Rs. 300 + Rs. 600) \times 8 weeks = 1,36,00,000

2,61,00,000

5. Less credit allowed by creditors

52,000 units ÷ 52 weeks

× Rs. 800** × 4 weeks

32,00,000

Net working capital requirements

2,29,00,000

* Credit to debtors is relating to finished stock which costs Rs. 1,700 per unit.

** Credit by creditors is relating to stock which costs Rs. 800 per unit.

B.E. Analysis (Contribution at different capacity levels)

Problem 30. (a) What are the various ways in which marginal costing can help management? Under what circumstances prices can be fixed below marginal cost?

- (b) From the following figures find the break-even volume :

Selling price per tonne — Rs. 69.50

Variable cost per tonne — Rs. 35.50

Fixed Expenses — Rs. 18.02 lakhs

If this volume represents 40% capacity, what is the additional profit for an added production of 40% capacity, the selling price of which is 10% lower for 20% capacity production and 15% lower, than the existing price, for the other 20% capacity.

Solution. For (a) Please refer to *Advanced Cost and Management Accounting—Text by Saxena and Vashist*

- (b) **Existing Break-even Sales**

BES × P/V ratio = Fixed Cost

BES × {(69.50 - 35.50) ÷ 69.50} = Rs. 18.02 lakhs

Rs. = 36,83,500 or 53,000 tonnes

It is given that 53,000 tonnes represent 40% capacity.

∴ 80% will be represented by 1,06,000 tonnes

Any contribution beyond this represents profit

- (i) Contribution by 20% capacity for which selling price falls by 10%

Revised Selling Price = Rs. 69.50 - Rs. 6.95 = 62.50

Variable Cost = 35.50

Contribution = 27.00

20% Capacity = 53,000 tonnes + 2 = 26,500 tonnes

Profit if sale price is Rs. 62.50 = Sales after BES × P/V ratio
 = (26,500 × 62.50) × (27.05 ÷ 62.50)
 = Rs. 7,16,825.

- (ii) Contribution by 20% capacity for which selling price falls by 15%.

$$\begin{array}{rcl} \text{Revised Selling Price} & = & \text{Rs. } 69.50 - \text{Rs. } 10.425 = \text{Rs. } 59.075 \\ \text{Variable Cost} & & = 35.500 \end{array}$$

$$\text{Contribution per tonne} \quad \underline{\underline{23.575}}$$

Profit if Sale price is Rs. 59.075 per tonne

$$\begin{array}{l} \therefore \text{Sale representing 20\% capacity} \times \text{P/V Ratio} \\ \therefore (26,500 \times \text{Rs. } 59.075) \times (\text{Rs. } 23.575 \div 59.075) \\ \therefore \text{Rs. } 6,24,737 \end{array}$$

\therefore Additional profit by 40% Sales

$$\begin{array}{l} \therefore \text{Profit in (i) and (ii)} \\ \therefore \text{Rs. } 7,16,825 + \text{Rs. } 6,24,737 = \text{Rs. } 13,41,562. \end{array}$$

Make or Buy Decision (Alternative use of spare capacity-- Opportunity cost)

Problem 31. An engineering company produces *P* in its production shop 'A'. The overhead recovery rate is 100% of direct wages based on the following budgeted figures :

Direct wages	1,60,000
Variable overheads	64,000
Fixed overheads	96,000

The production plan for the same budget period envisages an output of 18,000 units of Product *P* whose sales and cost data are as under :

	Rs./unit
Selling Price	42
Direct Materials	12
Direct Wages	8
Total Overheads	8

The company proposes to use the balance capacity of Shop *A* after completing the above said production plan, for the manufacture of component *Q* whose cost data are as under .

	Rs./unit
Direct Materials	8
Direct Wages	16
Total Overheads	16

The component *Q* is used by the company in the manufacture of some other product in another Production Department.

The company receives an export order from abroad for the purchase of 2,000 units of Product *P* at Rs. 30 each. This offer can be accepted by diverting the capacity from component *Q*. In that event the company has to buy the component which is available from an outside supplier at a price of Rs. 40 each.

You are required to evaluate the alternative courses of action and state with reasons whether the spare capacity should be utilised for the manufacture of : (a) The component *Q*, or

(b) 2,000 units of Product *P* for export and buying of the component *Q* from the outside supplier.

Solution. (i) *Cost data as per budget*

Wages	Rs. 1,60,000
Variable Cost	64,000
Fixed Cost	96,000

It means that Variable Cost is $(64,000 \div 1,60,000) \times 100 = 40\%$.

(ii) *Determination of balance capacity*

Production of P as per budget = 18,000 units

\therefore Wages Cost for P = $18,000 \times 8 = \text{Rs. } 1,44,000$

\therefore Capacity corresponding to wage cost of Rs. 1,60,000, i.e. Rs. 1,60,000 – Rs. 1,44,000 can be used for production of component Q.

Since Direct wages of component Q = Rs. 16

No. of components Q that can be produced

$$= \text{Rs. } 16,000 \div 16 = 1000 \text{ units.}$$

(iii) *Marginal Cost for producing 1,000 Units of component Q*

Raw Materials	$1,000 \times \text{Rs. } 8$	= Rs. 8,000
Wages	$1,000 \times \text{Rs. } 16$	= 16,000
Variable Cost (40% of wages)		= 6,400

Marginal Cost	30,400
---------------	--------

(iv) *Opportunity Cost for producing P.*

If this capacity is used for P, Component Q will have to be purchased from market @ Rs. 40 each.

$$1,000 \text{ unit} \times \text{Rs. } 40 = \text{Rs. } 40,000$$

Difference of Rs. 9,600 i.e. Rs. 40,000 – Rs. 30,400 is the opportunity cost of producing P. If capacity corresponding to wages of Rs. 16,000 is produced for P,

No. of Additional units of P to be produced

$$= \text{Rs. } 16,000 \div \text{Rs. } 8 = 2,000 \text{ units}$$

Marginal Cost per unit of P

Raw Material	Rs. 12.00
Direct wages	8.00
Variable Cost (40% of Direct wages)	3.20
	23.20

Contribution	6.80
Selling Price per unit of P (for exporting)	30.00

Total additional contribution by 2,000 units
 $= 2,000 \text{ units} \times \text{Rs. } 6.80 = \text{Rs. } 13,600$

This additional contribution of Rs. 13,600 should be matched with opportunity cost of Rs. 9,600 to decide whether balance capacity should be used for P or for Q.

Since additional contribution is more than opportunity cost, decision should be to export additional 2,000 units of P and buy component Q from outside P. This will increase profit by Rs. 4,000, i.e. Rs. 13,600—Rs. 9,600.

I.C.W.A. Final, June 1988

For question on Transfer Pricing, please refer to problem 13'22 on page P 13'49).

For question on Optimal Product Mix using L.P, please refer to Problem 15'14 on page P. 15'22.)

Choice of best alternative (Quoting for tenders to Government and Export Order).

Problem 32. PH Ltd. which is presently marketing two products A and B has prepared the following budget estimates for year 19X1.

	<i>Products</i>	
	<i>A</i>	<i>B</i>
Direct Material Cost/unit	Rs. 40	Rs. 55
Direct Labour Cost/unit	Rs. 64	Rs. 80
(Direct Labour Hour Rate Rs. 4)		
Selling Price per unit	Rs. 180	Rs. 260
Budgeted Sales (units)	300	160

The cost accountant has presented the annual flexible budget allowance of overheads for two levels of direct labour hours as under :

	<i>Direct Labour Hours</i>	
	11,000	12,000
Supervision	Rs. 1,800	Rs. 1,800
Indirect Labour	7,700	8,400
Consumable Stores	4,400	4,800
Repairs & Maintenance	7,200	7,400
Power	1,100	1,200
Fuel	4,800	5,200
Depreciation	2,000	2,000
Other Overheads	2,800	2,800
	31,800	33,600

The management desires that efforts should be made to achieve fuller utilisation of the capacity of 12 000 direct labour hours. Accordingly the three proposals put forth by the Marketing Manager came up for consideration. They are :

(a) A Government department has invited tenders for the supply of 200 units of Product 'C' whose particulars are : Raw Materials Rs. 30 per unit. Direct Labour hours 10 per unit.

(b) The Company has received an export order for the supply of 250 units of Product D. The product data are : Direct Material Rs. 20

per unit. Direct Labour hours Rs. 4 per unit. Export price offer received Rs. 40 per unit.

(c) The holding company has received an order for a specialised product for which a new component has been designed by them. As the component is a non-standard item, the holding company desires that it should be manufactured by PH Ltd. The holding company is prepared to buy the component at Rs. 160 per unit and its annual requirement is 100 units. The direct material cost of the component is Rs. 60 and it takes 16 direct labour hours to manufacture one unit.

Required : (i) Calculate the budgeted overhead recovery rates separately for variable and fixed overheads for the year 19X1.

(ii) State, with workings, the minimum tender price which should be offered to the Government department for the supply of Product 'C'.

(iii) Evaluate the other two proposals contained in (b) and (c) above and advise on the acceptance or otherwise of these proposals.

(iv) Assuming that the order given for Product 'C' is accepted by the Government department, prepare a statement of profitability for 19X1 incorporating the said order and your decisions on (iii) above.

Solution. Working Notes

1. Calculation of budgeted labour hours

Product	A	B	Total Hrs.
Direct Wages	Rs. 64	Rs. 80	
Direct wage rate per hour	Rs. 4	Rs. 4	
Direct Labour hours per unit	16	20	
Budgeted Sales (units)	300	160	
Budget hours	4,800	3,200	8,000

(i) **Statement showing overhead recovery rate for variable and fixed overhead for the year 19X1.**

	Direct Labour hours.		Nature of Oil	For normal 8,000 hrs.	
	For 11,000 hrs.	For 12,000 hrs.		Fixed	Variable
Supervision	Rs. 1,800	Rs. 1,800	F	Rs. 1,800	Rs.
Indirect labour	7,700	8,400	V	—	5,600
Consumable stores	4,400	4,800	V	—	3,200
Repair & Maintenance	7,200	7,400	SV	5,000	1,600*
Power	1,100	1,200	V	—	800
Fuel	4,800	5,200	SV	400	3,200
Depreciation	2,000	2,000	F	2,000	—
Other overheads	2,800	2,800	F	2,800	—
Total	31,800	33,600		12,000	14,400
Overhead recovery rate				Rs. 1.5	Rs. 1.8

* Increase of 1,000 hrs. causes an increase of Rs. 200 in repair and maintenance. Therefore variable component of R. & M. is Re. 0.2 per hour

∴ Variable component of R & M for 11,000 hrs	= Rs. 2,200
Total R & M for 11,000 hrs	= Rs. 7,200
Fixed component of R & M	5,000
Repair & Maintenance for 8,000 hours =	
Variable $8,000 \times 0.2$	= Rs. 1,600
Fixed	5,000
	6,600

It has been calculated same way

Increase of 1,000 hrs causes an increase of Rs. 400

∴ Variable component of fuel cost = Rs. 0.4	
Variable component of fuel cost for 11,000 units	= Rs. 4,400
Total fuel Cost Given	= Rs. 4,800

Fixed component of fuel cost	400
------------------------------	-----

New Fuel Cost for 8,000 hrs :

Variable Component $(8,000 \times 0.4)$	= Rs. 3,200
Fixed	400

Variable Cost	3,600
---------------	-------

(ii) Minimum tender price to be offered to Government for supply of product C.

Variable Cost of Product C.

Raw Material	= Rs. 30.00
D. Labour 10 hrs \times Rs. 4	= Rs. 40.00
V. Component of overhead 10 hrs \times 1.8	= 18.00
	88.00

Minimum price should be Rs. 88.00 per unit

Total hrs. to be used for C will be $= 200 \text{ units} \times 10 \text{ hrs.}$
 $= 2,000 \text{ units}$

(iii) Evaluation of Proposal (b) and (c)

Proposal (b)

Variable Cost of Product D:

Materials	= Rs. 20.00
D. Wages 4 hrs \times Rs. 4	= Rs. 16.00
Variable overhead 4 hrs \times Rs. 1.8	= Rs. 7.20

43.20

Selling Price offered = Rs. 40.00

Since even variable cost is not recovered, order is not acceptable.

Proposal (c)**V. Cost of Component**

Material	Rs. 60'00
D. Wages 16 hrs × 4	64'00
V.O. 16 hrs × 1'8	28'80
	<hr/>
	152'80
	<hr/>
Price offered	160'00

Offer is acceptable since it is yielding contribution and spare capacity also exists.

Acceptance of this offer will utilize 1,600 hrs. i.e., 100 units × 16 hrs. PH Ltd. should :

Produce A and B as per budget for which	
hours utilized will be (Refer to Note 1)	= 8,000
Produce C, for which hours to be utilized will be	= 2,000
Refer to (ii) above.	
Produce Special Component (Refer to	= 1,600
(iii) Proposal (c) above)	<hr/>
	11,600
	<hr/>

Since 11,600 hours. are within capacity (12,000 hrs), Company can execute the proposed plans.

(iv) **Statement showing the profit of P.H. Ltd., if above proposals are accepted.**

	A	B	C	Special Component	Total
Sales (units)	300	160	200	100	
Selling Price (Rs.)	180	260	88	160	
Sales value (Rs.)	54,000	41,600	17,600	16,000	1,29,200
	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
Variable Cost					
Direct Material per unit	40	55	30	60	
D.M. Cost	12,000	8,800	6,000	6,000	32,800
D.W. per unit	64	80	40	64	
D. Wages	19,200	12,800	8,000	6,400	46,400
Variable OH per unit	28'80	36'00	18'00	28'80	
V. Overhead	8,640	5,760	3,600	2,880	20,880
	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
Total V. Cost					1,00,080
	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
Contribution					29,120
Fixed Overhead					12,000
	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
Profit					17,120
	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>

Choice of Best Alternative (Further Processing/Substitution of material)

Problem 33. SV Ltd. is able to obtain 2,00,000 kg. of *AXE* and 4,00,000 Kg. of *BXE* from the input of 6,00,000 Kg. of raw material '*F*'. The selling prices of these articles are *AXE* Rs. 6 per kg and *BXE* Rs. 4.50 per kg. The processing costs amount to Rs. 20 lacs per month as under :

Raw Material ' <i>F</i> ' 6,00,000 kg. \times Rs. 2.	Rs. 12,00,000
Variable processing costs	6,00,000
Fixed processing costs	2,00,000
Total	20,00,000

The company has the following three proposals under consideration :

(a) Product *AXE* can be further processed by mixing it with other purchased materials. There is a market potential for absorbing the entire product *AXE* when processed further into *PXE*. The selling price of *PXE* is Rs. 13 per kg. Each kg. of *PXE* requires one kg. of *AXE* as raw material. Additional cost of other material labour and overheads to process *AXE* into *PXE* amount to Rs. 16,00,000 per month.

(b) There is an offer to purchase an additional quantity of 40,000 kgs of *BXE* at a price of Rs. 3.50 per kg. The existing market for *BXE* would not be affected by the acceptance of this proposal. All units of *AXE* will be sold at a uniform price.

(c) A new raw material has just become available. The processing costs will remain the same but the process will yield 2 kgs of *AXE* for every 3 kg. of *BXE*. The total quantity of the new raw materials is limited to 6,00,000 kg.

Required : (i) Find the profitability arising from the sale of *AXE* and *BXE* as originally envisaged.

(ii) Evaluate the proposal for further processing of *AXE* into *PXE* and present a statement of profitability.

(iii) Analyse the proposal for the manufacture of an additional quantity of 40,000 kg. of *BXE* contained in (b) above. In view of the increased quantum of sales of *AXE*, the price will go down. Find the minimum reduced average price for *AXE* to sustain the increased sales.

(iv) Evaluate the proposal for substitution of the existing raw materials by new raw materials and find the maximum price the company can afford to pay for the new raw material for retaining the existing profitability.

Solution. (i) Sales : <i>AXE</i> 2,00,000 kg \times Rs. 6	12,00,000
<i>BXE</i> 4,00,000 kg \times Rs. 4.50	18,00,000
	30,00,000

Costs :

Raw Materials	Rs. 12,00,000	
Variable Costs	6,00,000	
Fixed Costs	2,00,000	20,00,000
		<hr/>
Profit		10,00,000
		<hr/>

(ii) Revenue from *PXE* = Rs. 13 per kgRevenue from *AXE* = 6 per kg

Incremental Revenue 7 per kg

Total Incremental Revenue 2,00,000 kg \times 7	14,00,000
Total Incremental cost of <i>PXE</i>	16,00,000
	<hr/>
Loss	(2,00,000)
	<hr/>

Hence the proposal results in a loss and therefore it is not acceptable.

(iii) *AXE* and *BXE* are produced in the ratio of 1 : 2. If 40,000 units of *BXE* are produced, 20,000 units of *AXE* will have to be produced. Thus input will be 60,000 kg.

\therefore Additional Material Cost will be 60,000 kg. \times Rs. 2 = Rs. 1,20,000
 Additional Processing Cost will be 60,000 \times Re. 1 = 60,000

Total Additional Cost (a)	1,80,000
The additional revenue to be generated by <i>BXE</i> 40,000 kg. \times 3.50 (b)	1,40,000
	<hr/>
Balance to be recovered (a - b)	40,000
	<hr/>

Total Revenue required from *AXE* :

Current Sales 2,00,000 kg. \times Rs. 6	12,00,000
Balance to be recovered as above	40,000
	<hr/>
	12,40,000
	<hr/>

This revenue of Rs. 12,40,000 has to be recovered from 2,20,000 kg. of *AXF*, i.e., 2,00,000 kg. original quantity + 20,000 kg. new increase due to increase in production of *BXE*.

Average minimum Price = Rs. 12,40,000 \div 2,20,000 kg. = Rs. 5.64 per kg.

(iv) Again input of substituted material of 6,00,000 kg. is to be made. Processing cost will remain the same, but output ratio changes and now 2 kg. of *AXE* will be produced for every 3 kg. of *BXE*. Thus difference in sales revenue will be as follows :

<i>Original</i>				<i>Proposed</i>			
	<i>Qty</i>	<i>Rate</i>	<i>Rs. Total Rs.</i>		<i>Qty</i>	<i>Rate</i>	<i>Rs. Total Rs.</i>
<i>AXE</i>	2,00,000 ×	6	= 12,00,000		2,40,000*	6	= 14,40,000
<i>BXE</i>	4,00,000 ×	4.50	= 18,00,000		3,60,000*	4.50	= 16,20,000
	6,00,000		30,00,000		6,00,000		30,60,000

*Input of 6,00,000 kg. of substituted material will give output of *AXE* and *BXE* in the ratio of 2 : 3 respectively.

Additional revenue is Rs. 60,000. To this extent price can be revised. Thus Rs. 60,000 spread over 6,00,000 kg. = Re. 0.10 per kg.

Material price can be up to Rs. 2.10, i.e.,

Rs. 2.00 original and Re. 0.10 due to additional revenue due to substitution.

Variance Analysis (Factors contributing to change in profit—B.E. Analysis)

Problem 34. The profitability of a company for two years ended 31st March after eliminating the effects of inflation is as under :

	<i>Years ended 1987</i>	<i>31st March 1988</i>
	<i>Rs. in lacs</i>	<i>Rs. in lacs</i>
Sales	1,200	1,540
Direct materials	600	648
Direct wages and variable overhead	360	412
Fixed overheads	160	300
Profit	80	180

Consequent upon the reorganisation of production methods and improvement in quality, the company has been able to secure an increase in the selling prices by 10% during the year ended 31st March, 1988.

The position of consumption of materials and utilisation of direct labour hours during the two years is as under :

	<i>1987</i>	<i>1988</i>
Direct Materials (Tonnes)	4,80,000	5,40,000
Direct Labour Hours	72,00,000	80,00,000

Required : (i) Keeping the year ended 31st March, 1987 as the base year, analyse the result of the year ended 31st March, 1988 to show the amount which each factor has contributed to the change in the profit.

(ii) Find the break-even sales for both the years.

(iii) Calculate the percentage increase in selling price that would have been further necessary over the sales value for the year ended 31st March 1987 to earn a margin of safety of 40%.

Solution (i) For Sales Value Variances

SV₁—Actual Sales Value realised = Rs. 1,540 lakhs

SV₂—Standard Sales Value of actual sales.

$$(\text{Rs. } 1,540 \text{ lakh} \div 110) \times 100 = \text{Rs. } 1,400 \text{ lakhs.}$$

SV_3 —Not applicable

SV_4 —Standard Sales Value as per budget = Rs. 1,200

Sales Value Price Variance ($SV_1 - SV_2$)

$$= \text{Rs. } 1,540 - \text{Rs. } 1,400 = \text{Rs. } 140 \text{ lakhs. (F)}$$

Sale Value Quantity Variance ($SV_2 - SV_4$)

$$= \text{Rs. } 1,400 - \text{Rs. } 1,200 = \text{Rs. } 200 \text{ lakhs. (F)}$$

Determination of Profit Impact on Sales Value Volume Variance.

(a) Sales of 1988 expressed at par with 1987 prices = Rs. 1,400 lakhs
Less Standard cost corresponding to this sales.

Material	Rs. 700 lakhs.	
D. Wages	420 lakhs	
Fixed O.H.	160 lakhs	1280 lakhs
	---	---
Standard profit		120 lakhs

(b) Sales of 1987

Rs. 1,200 lakhs

Less—Material Rs. 600 lakhs

D. Wages 360 „

Fixed O.H. 160 „

1120

Profit

80

Profit increase due to Volume Variances = Rs. 120 lakhs—80 lakhs
(a—b) = Rs. 40 lakhs.

For Material Variances

M_1 —Actual material cost incurred in 1988 = Rs. 648 lakhs.

M_2 —Standard cost of material used or material purchased at cost of 1987

$$= (\text{Rs. } 60,00,000 \div \text{Rs. } 4,80,000) \times 5,40,000 = \text{Rs. } 675 \text{ lakhs.}$$

M_3 —Not Applicable.

M_4 —Standard Material Cost of output

$$(\text{Rs. } 600 \text{ lakh} \div 1,200 \text{ lakhs}) \times 1,400 \text{ lakhs.} = \text{Rs. } 700 \text{ lakhs.}$$

Material Price Variance = $M_1 - M_2$ = Rs. 648 lakhs—Rs. 675 lakhs.
= Rs. 27 lakhs. (F)

Material Usage = $M_2 - M_4$

$$= \text{Rs. } 675 \text{ lakhs} - \text{Rs. } 700 \text{ lakhs} = \text{Rs. } 25 \text{ lakhs (F)}$$

For Direct Wage Variance and Variable OH Variance

L_1 —Actual payment made to workers for actual hours in 1988
= Rs. 412 lakhs.

L_2 —Payment involved, if the payment had been at the rate of 1987
(Rs. 360 lakhs \div 720) \times 800 lakhs = Rs. 400 lakhs.

L_3 —Not applicable

L_4 —Standard labour cost of output achieved
 (Rs. 360 lakhs \div 1,200 lakhs) \times Rs. 1,400 lakhs = Rs. 420 lakhs

Wage Rate Variance = $L_1 - L_2$ = Rs. 412 lakhs — Rs. 400 lakhs
 = Rs. 12 lakhs (A)

Wage Efficiency Variance = $L_2 - L_4$ = Rs. 400 lakhs — Rs. 420 lakhs
 = Rs. 20 lakhs (F)

Fixed Overhead Variance

FO_1 —Actual fixed overhead incurred in 1988 = Rs. 300 lakhs.

FO_2 —Budgeted fixed overhead for the period = 160 lakhs

FO_4 —Standard fixed overhead for the output = Rs. 160 lakhs.

Fixed overhead expenditure variance = $FO_1 - FO_2$
 = Rs. 300 lakhs — Rs. 160 lakhs = Rs. 140 lakhs (A)

Profit figure has increased from Rs. 80 lakhs in 1987 to Rs. 180 lakhs in 1988 by Rs. 100 lakhs and reasons for variations can be summarised as follows :

Sales Price Variance	Rs. 140 lakhs (F)
Sales Margin Volume Variance	Rs. 40 lakhs (F)
Material Price Variance	Rs. 27 lakhs (F)
Material Usage variance	Rs. 25 lakhs (F)
D. Wage Rate Variance	Rs. 12 lakhs (A)
D. Wage Efficiency	Rs. 20 lakhs (F)
Fixed Overhead Expenditure Variance	Rs. 140 lakhs (A)

	Rs. 100 lakhs (F)

Alternatively, Variances can be explained as follows as well :

Statement showing the reconciliation of profit

Actuals for 1988 (Given)	Variances Favourable Adverse		(Rs. in lakhs) Sales of 1988 at 1987 level of sales & cost Rs. lakhs	Actuals for 1987 (Given)
Sales	1,540			
Sales Price Variance	140		1,400	1,200
=====			=====	=====
Material Cost	648			
Price Variance {	27			
Usage Variance {	25		700	600
Labour Cost	412			
Rate Variance {		12		
Usage Variance {	20		420	360
Fixed O.H.	300			
Exp. Variance		140	160	160
	=====	=====	=====	=====
Total	1,360	212*	1,280	1,120
	=====	=====	=====	=====
Profit	180		120@	80@
	=====		=====	=====

Summary *	Total Favourable Variance as explained above	= Rs. 212 lakhs.
	@ Profit Variances due to volume	= 40 lakhs.
	Total favourable variance	252 lakhs
	Less Adverse Variance as explained above	152 lakhs
		<u>Rs 100 lakhs</u>

This explains why profit goes up from Rs. 80 lakhs in 1987 to Rs. 180 lakhs in 1988.

(i) **B.E. Sales \times P V ratio = Fixed Cost**

1988	1987
BES = Rs. $(300 \times 1,540) \div 480$	BES = $(160 \times 1,200) \div 240$
= Rs. 962.50 lakhs	= Rs. 800 lakhs

(ii) **Margin of safety.**

	Rs. lakhs	1987
	1988	400
a) Rs. 1,200 — Rs. 800		
(b) Rs. 1,540 — Rs. 962.50	577.50	
% of Margin of Safety	37.50	

If margin of safety is to be 40%, BES will be 60%.

Suppose break-even sales of Rs. 962.5 lakhs in 1988 represents 60% of selling price.

\therefore Total Sales = $(962.50 \div 60) \times 100 =$ Rs. 1604.2 lakhs

Increase required in selling price to raise margin of safety to 40%
 = Rs. 1604.2 — 1540
 = Rs. 64.2 lakhs

\therefore % increase required in selling price.
 = $(\text{Rs. } 64.2 \div 1540 \text{ lakhs}) \times 100 = 4.17\%$

For question on Variance Analysis—Operating Statement, please refer to Problem 12.22 on page P 12.31.

Minimum Price to be quoted for an order (Relevant Cost Concept)

Problem 35. (a) A machine which originally cost Rs. 12,000 has an estimated life of 10 years and is depreciated at the rate of Rs. 1,200 per year. It has been unused for some time, however, as expected production orders did not materialise.

A special order has now been received which would require the use of the machine for two months.

The current net realisable value of the machine is Rs. 8,000. If it is used for the job, its value is expected to fall to Rs. 7,500. The net book

value of the machine is Rs. 8,400. Routine maintenance of the machine currently costs Rs. 40 per month. With use, the cost of maintenance and repairs would increase to Rs. 60 per month.

What would be the relevant cost of using the machine for the order so that it can be charged as the minimum price for the order.

(b) X Ltd. has been approached by a customer who would like a special job to be done for him and is willing to pay Rs. 22,000 for it. The job would require the following materials :

Material	Total units required	Units already in stock	Book value of units in stock, Rs./unit	Realisable value Rs./unit	Replace- ment cost Rs./unit
A	1,000	0	—	—	6
B	1,000	600	2	2.5	5
C	1,000	700	3	2.5	4
D	200	200	4	6	9

(i) Material B is used regularly by X Ltd. and if stocks are required for this job, they would need to be replaced to meet other production demand.

(ii) Materials C and D are in stock as the result of previous excess purchase and they have a restricted use. No other use could be found for material C but material D could be used in another job as substitute for 300 units of material E, which currently cost Rs. 5 per unit (of which the company has no units in stock at the moment).

What are the relevant costs of material, in deciding whether or not to accept the contract? Assume all other expenses on this contract to be specially incurred besides the relevant cost of material is Rs. 550.

Solution. Relevant Costs of using the machine for the order

(i) Loss in the net realisable value of machine by using it on the order (Rs. 8,000—Rs. 7,500)	Rs. 500
(ii) Additional maintenance and repair for two months, i.e.. (Rs. 60—Rs. 40) × 2	Rs. 40
Minimum price	<u>540</u> <u>==</u>

Notes. (i) Books value of Rs. 8,400 is irrelevant for decision.

(ii) Net realisable value falls from Rs. 8,000 to Rs. 7,500. This loss of Rs. 500 is relevant for decision, because it is influenced exclusively by the decision.

(iii) Rs. 7,500 will be realised after two months at least. Therefore time value of Rs. 7,500 for two months is relevant cost. Therefore present value of future realisable value of Rs. 7,500 should be found out and this present value should be deducted from Rs. 8,000. This will be

the correct relevant cost in place of Rs. 500 shown above in absence of discounting factor.

(b) (i) Material *A* is not yet owned. It would have to be purchased in full at the replacement cost of Rs. 6.00 per unit.

(ii) Material *B* is used by the company regularly. There is already existing a stock of 600 units. If these are used in the contract, a further 600 units would have to be purchased.

Relevant cost is therefore 100 units at the replacement.

(iii) Material *C* : 1,000 units of material *C* are required. 700 units are already in stock. If it is used for the contract, a further 300 units will have to be purchased at a replacement cost of Rs. 4.00 each. The existing stock of 700 units will not be replaced. If they are used for the contract, they cannot be used @ Rs. 2.50 each unit. The realisable value of these 700 @ Rs. 2.50 per units represent opportunity cost.

(iv) Material *D* is already in stock and will not be replaced. There is an opportunity cost of using *D* in the contract. It has following two uses :

It can be sold to fetch Rs. 1,200 i.e., $600 \times \text{Rs. } 2$

It can also be used for *E*, which would cost Rs. 1,500
i.e., $300 \times \text{Rs. } 5$.

Since substitution is more useful, Rs. 1,500 is the opportunity cost.

c) Summary of relevant costs :

Material <i>A</i>	$1,000 \times \text{Rs. } 6 =$	Rs. 6,000
Material <i>B</i>	$1,000 \times 5 =$	Rs. 5,000
Material <i>C</i>	$\left. \begin{array}{l} 700 \times 2.5 \\ 300 \times 4 \end{array} \right\} =$	$\left\{ \begin{array}{l} 1,750 \\ 1,200 \end{array} \right.$
Material <i>D</i>	$300 \times 5 =$	1,500
Other expenses		550
Total relevant cost		16,000

(d) Contract should be accepted since price offered is Rs. 22,000 in relation to relevant cost of Rs. 16,000.

For question on Evaluation of alternative plans by use of probability, please refer to Problem 15.15.

Accepting an Export order (Increase in capacity by additional installing plant or overtime working)

Problem 36. A manufacturing company currently operating at 80% capacity has received an export order from Middle East, which will utilise 40% of the capacity of the factory. The order has to be either taken in full and executed at 10% below the current domestic prices or rejected totally.

The current sales and cost data are given below :

Sales—Rs. 16.00 lakhs.

Direct Material—Rs. 5.80 lakhs

Direct Labour—Rs. 2.40 lakhs

Variable Overhead—Rs. 0.60 lakhs

Fixed Overheads—Rs. 5.20 lakhs

The following alternatives are available to the management :

- A. Continue with domestic sales and reject the export order
- B. Accept the export order and allow the domestic market to starve to the extent of excess demand.
- C. Increase capacity so as to accept the export order and maintain the domestic demand by :
 - (i) purchasing additional plant and increasing 10% capacity and thereby increasing fixed overheads by Rs. 65,000, and
 - (ii) working overtime at one and half time the normal rate to meet balance of the required capacity.

You are required to evaluate each of the above alternatives and suggest the best one.

Solution.

(A) Continue with domestic sales and reject the export order

Capacity utilization	80%
Sales	Rs. 16.00 lakhs.
Less : Variable cost	8.80
Contribution	7.20
Less : Fixed Cost	5.20
Profit	2.00

(B) Accept the export order without increase in capacity

It is given that export order will utilize the 40% of the capacity. It is therefore necessary to work out 100% capacity (Rs. 16 lakhs ÷ 80% = Rs. 20 lakhs.)

Domestic sales (60% of Rs. 20 lakhs)	Rs. 12.00 lakhs.
Export sales (40% of Rs. 20 lakhs × 90%)	7.20
Total Sales	19.20
Less : Variable cost (8.80 × 100 ÷ 80)	11.00
Contribution	8.20
Less : Fixed Cost	5.20
Profit	3.00

**(C) Revised Capacity—Domestic sales
—Export sales**

Domestic sales	16.00
Export sales	7.20
Total	Rs. 23.20 lakhs

Less : Variable cost :

Direct Materials (Proportionate increase for 20%*		
Increase in capacity $(5.80 \div 0.8) \times 1.2$		8.70
Direct labour $(2.40 \div 0.8) \times 1.2$	3.60	
Add : Extra for overtime working :		
At 80% capacity, direct wages = 2.40		
At 100% capacity, direct wages = 3.00		
10% additional increase in capacity with overtime working $(10\% \text{ of } 3) \times \frac{1}{2}$	0.15	3.75
Variable overhead $(0.6 \div 0.8) \times 1.20$	—	0.90
Total variable cost		13.35
Contribution		9.85
Less : Fixed cost $(5.20 + 0.65)$		5.85
Profit		4.00

The net profit is highest, if alternative (c) is adopted and therefore the same is suggested.

For question on Learning Curve please refer to Problem 15.16.

For question on Probability (Expected value of perfect information, please refer to Problem 15.17.)

For question on Probability—Sensitivity Analysis, please refer to Problem 15.18.

For question on Inflation Accounting, please refer to Problem 14.5.

Programme Budgeting

Problem 37. (a) How does Programme Budgeting differ from Performance Budgeting? Explain the term Multiyear Costing as used in PPBS.

(b) The Good City Police Department traditionally has prepared a functional Budget and now there is discussion about using a programme budget in an effort to control activities better and do a better job of securing resources from the state government. Below are the proposed functional budget for the next year and estimated data concerning the percentage of functional item costs assignable to each of the four major programmes of the police department.

Good City Police Department Proposed Functional Budget

Salaries	Rs. 5,25,000
Vehicle Costs	2,50,000
Supplies	1,25,000

* Revised capacity without price reduction on exports Rs. 16 lakhs + $(7.20 \div 0.9)$ — Rs. 24 lakhs percentage increase = 20%

Utilities	50,000
Miscellaneous	44,000
Total	9,94,000

Percentage of Costs Assignable to each Programme

	<i>Crime Prevention</i>	<i>Criminal Investigation</i>	<i>Criminal Proceedings</i>	<i>Traffic Movement</i>
Salaries	60%	20%	10%	10%
Vehicle Costs	70	20	2	8
Supplies	20	30	20	30
Utilities	10	60	20	10
Miscellaneous	30	25	20	25

Required : Prepare a Programme budget for the next year.

Solution. (a) Please refer to "Advanced Cost and Management Accounting—Text" by Saxena and Vashist.

(b) The figures of functional budget have been computed programme-wise as under

<i>Functional Budget</i>	<i>Crime Prevention</i>	<i>Criminal Investigation</i>	<i>Criminal Proceedings</i>	<i>Traffic Movement</i>	<i>Total</i>
Salaries	Rs. 3,15,000	Rs. 1,05,000	Rs. 52,500	52,500	5,25,000
Vehicle Costs	1,75,000	50,000	5,000	20,000	2,50,000
Supplies	25,000	37,500	25,000	37,500	1,25,000
Utilities	5,000	30,000	10,000	5,000	50,000
Miscellaneous	13,200	11,000	8,800	11,000	44,000
	5,33,200	2,33,500	1,01,300	1,26,000	9,94,000

Thus Good City Police Department Programme Budget will be :

Crime Prevention	Rs. 5,33,200
Criminal Investigation	2,33,500
Criminal Proceedings	1,01,300
Traffic Movement	1,26,000
Total	9,94,000

For question on Inflation Accounting and Backlog Depreciation, please refer to Problem 14'6.

Determination of bonus to employees by use of added value concept

Problem 38. Worthwhile Corporation had been preparing Value Added Statements for the past five years. The Personnel Manager of the Company has suggested that a value added incentive scheme when introduced will motivate employees to better performance. To introduce the scheme, it is proposed that the best index performance, i.e. Employee Costs to Added Value for the last 5 years, will be used as the target index for future calculations of the bonus to be earned.

After the target index is determined, any actual improvement in the index be will rewarded, the employer and employees sharing any such Bonus in the ratio 1 : 2. The Bonus is given at the end of the year, after the profit for the year is determined.

From the following details, find out the bonus to be paid to the employees, if any, for 1987 :—

<i>Value Added Statement for 5 years (Rs. '000)</i>					
Year	1982	1983	1984	1985	1986
Sales	2,800	3,800	4,600	5,200	6,000
Less Bought in goods and services	1,280	2,000	2,500	2,800	3,200
Added Value	1,520	1,800	2,100	2,400	2,800
Employee costs	650	760	840	984	1,120
Dividends	100	150	200	240	300
Taxes	320	380	420	500	560
Depreciation	260	310	360	440	560
Debenture Interest	40	40	40	40	40
Retained Earnings ;	150	160	240	196	220
Added Value	1,520	1,800	2,100	2,400	2,800

Summarised Profit & Loss Accounts for 1987 (Rs. '000)

Sales					7,300
Less Cost of Materials			2,500		
Wages			700		
Production Salaries			200		
Expenses			700		
Depreciation			500		
Administration Salaries			300		
Expenses			300		
Depreciation			200		
Debenture Interest			40		
Selling & Distribution Salaries			60		
Expenses			200		
Depreciation			60		
Profit					1540

Solution : Statement showing added value and amount of Bonus paid to Employees.

Year	1982	1983	1984	1985	1986
Employees Cost	650	760	840	984	1,120
Added Value	1,520	1,800	2,100	2,400	2,800
Percentage	43%	42%	40%	41%	40%
Target Index = 40%					

Sales

(Rs. '000)
7,300

Less : Cost of bought-out goods and services :

Materials	2,500	
Production expenses	700	
Admn. expenses	300	
Selling expenses	200	
	<hr/>	3,700
Added value		<hr/>
		3,600
		<hr/>

Employees Costs :

Wages	700	
Production salaries	200	
Admn. salaries	300	
Selling salaries	60	
	<hr/>	1,260

Working showing the bonus for 1987

Employees cost as per target index ($3,600 \times 40\%$)	1,440
Actual employees cost	1,260
	<hr/>
Saving/Improvement	180
Employees share = Rs. $1,80,000 \times 2/3$	= Rs. 1,20,000
	<hr/>

I.C.W.A. INTER, DECEMBER 1988**(Overhead Rate)**

Problem 39. The preliminary budget for a company with Four departments was as under :

Department	Direct Overhead Allocation	Apportioned Overhead (%)	Direct labour hours
1	Rs. 14,200	10	60,000
2	7,200	30	2,00,000
3	16,400	20	1,20,000
4	22,600	40	1,50,000
	<hr/>		<hr/>
Total	Rs. 60,400	Rs. 1,76,000	5,30,000
	<hr/>	<hr/>	<hr/>

It was decided to establish a new department (5) and to slightly re-organise the existing departments. The following alterations were agreed to in making a revised budget.

- A sum of Rs. 15,000 being additional overhead, will be allocated directly to department (5).
- An amount of Rs. 6,600/- being overhead previously allocated directly to department (3) will now be transferred to department (5).

(c) Rs. 30,000/- additional overhead expected to be incurred due to re-organisation, will be apportioned as follows :

Department	1	2	3	4	5
Proportion (%)	10	20	—	10	60

(d) Revised direct labour hours are expected to be :

Department	Hours
1	69,600
2	2,00,000
3	1,00,000
4	1,60,000
5	90,000
	<u>6,19,600</u>

You are required to calculate :

- The department direct labour hour rates of overhead, based on the preliminary budget.
- The departmental direct labour hour rates of overhead, based on the revised budget.
- The Overhead chargeable at the revised rates to one unit of product 'X' for which the following hours are spent in each department.

Department	1	3	4	5
Hours	6	4	8	3

Solution.

(a) **Departmental overhead rates based on the preliminary budget**

Department	Allocated overhead	Apportioned overhead	Total overhead (2+3)	Direct Labour hours	Direct Labour hours rate (4 ÷ 5)
(1)	(2)	(3)	(4)	(5)	(6)
1.	14,200	Rs. 17,600	31,800	60,000	Re. 0.53
2.	7,200	52,800	60,000	2,00,000	0.30
3.	16,400	35,200	51,600	1,20,000	0.43
4.	22,600	70,400	93,000	1,50,000	0.62
	<u>60,400</u>	<u>1,76,000</u>	<u>2,36,400</u>	<u>5,30,000</u>	

(b) Departmental overhead rates based on the revised budget.

Department	Total overhead as per preliminary Budget	Adjustments to preliminary Budget	Total overhead as per revised Budget (2±3)	Revised labour hours	Revised Departmental direct labour hour rate (Re.) (4÷5)
(1)	(2)	(3)	(4)	(5)	(6)
1.	Rs. 31,800	+ Rs. 3,000	Rs. 34,800	69,600	Rs. 0.50
2.	60,000	+ 6,000	66,000	2,00,000	0.33
3.	51,600	— 6,600	45,000	1,00,000	0.45
4.	93,000	+ 3,000	96,000	1,60,000	0.60
5.	—	+ 12,000 }	39,600	90,000	0.44
		+ 6,600 }	—	—	—
		+ 18,000 }	—	—	—
Total	2,36,400	45,000	2,81,400*	6,19,600	

*Total overhead as per preliminary budget— 2,36,400

Add : Additional overhead directly allocated to deptt. (5) 15,000

Additional overhead due to re-organisation 30,000

Total 2,81,400

(c) Overhead chargeable at the revised rates to one unit of product 'X'

Department	Hourly Rate	Hours spent	Amount of overhead chargeable
1.	Rs. 0.50	6	Rs. 3.00
3.	0.45	4	1.80
4.	0.60	8	4.80
5.	0.44	3	1.32
			Rs. 10.92

Under/Over Absorption—Before/After Mechanisation

Problem 40 (i) The budgeted working conditions of a Cost Centre are as follows :

Normal working per week	—42 hours
No. of machines	—14
Normal weekly loss of hours on maintenance etc.	—5 hours per machine
No. of weeks worked per year	—48

Estimated annual overheads	—Rs. 1,24,320
Estimated direct wage rate	—Rs. 4 per hour
Actual result in respect of a 4 week period are :	
Wages incurred	—Rs. 9,000
Overheads incurred	—Rs. 10,200
Machine hours produced	2,000

You are required to calculate :

- the overhead rate per machine hour , and
- the amount of under-or-over absorption of wages and overheads.

(ii) Management of a manufacturing unit is considering extensive modernisation of the factory through progressive mechanisation which would result in improved productivity and reduced strength. Through negotiations with the union, it was agreed that for every 1% increase in productivity, workers would be paid 0.5% incentive wages. It was also agreed that through voluntary retirement the staff strength would be reduced to 300 from the present level of 400. The following further comparative data are available before and after the proposed mechanisation :

	<i>Before Mechanisation</i>	<i>• After Mechanisation</i>
No. of articles produced per month	50,000	48,000
Fringe benefits	50% of wages	
Wages paid per month	Rs. 4,00,000	
Sales per month (value)	Rs. 24,00,000	
P/V ratio	25%	

Based on the above data, you are required to work out the annual financial implication of the proposal.

Solution. (i) (a) Normal working hours for the year

$$= 48 \text{ weeks} \times 42 \text{ hrs per-}$$

$$\text{week} \times 14 \text{ machines} = 28,224 \text{ hours}$$

$$\text{Loss in hours due to maintenance : } 48 \text{ weeks} \times 5 \text{ hours} \times 14 = 3,360 \text{ hrs.}$$

$$1. \text{ Net effective hour p.a.} = 28,224 - 3,360 = 24,864 \text{ hours}$$

$$2. \text{ Estimated annual overheads} = \text{Rs. } 1,24,320$$

$$3. \text{ Overhead rate per machine hour} = (2 \div 1) \text{ Rs. } 5$$

$$(b) \text{ Wages absorbed} = 4 \text{ weeks} \times 42 \text{ hours} \times 14 \text{ machines} \times \text{Rs. } 4 \\ = \text{Rs. } 9,408$$

$$\text{Wages incurred} \quad 9,000$$

$$\text{Over-absorbed wages} \quad 408$$

$$\text{Overhead absorbed} = 2,000 \text{ hours} \times \text{Rs. } 5 = \text{Rs. } 10,000$$

$$\text{Overhead incurred} \quad 10,200$$

$$\text{Under-absorbed overhead} \quad 200$$

(ii) **Improvement of productivity after mechanisation, Staff-strength reduced from 400 workers to 300 workers output of 300 workers**
before mechanisation $50,000 \times 300/400$ 37,500

Output of 300 workers *after* mechanisation 48,000

Additional output due to mechanisation 10,500

Improvement in productivity $= (10,500 \div 37,500) \times 100 = 28\%$

For every 1% increase in productivity, 0.5% incentive wages

Incentive wages for 28% $= 28\% \times 0.5\% = 14\%$

Annual wages payable to 300 workers before incentive

$\text{Rs. } 4,00,000 \times 300/400 \times 12 = \text{Rs. } 36,00,000$

Annual financial implication of the proposal

	<i>Before mechanisation</i>	<i>After mechanisation</i>
Wages p.a.	Rs. 48,00,000	Rs. 36,00,000
Fringe benefits (50%)	24,00,000	18,00,000
Incentive wages (14% of wages)	—	5,04,000
Total	72,00,000	59,04,000

Saving in wages = Rs. 12,96,000

Selling price per unit = Rs. $24,00,000 \div 50,000 = \text{Rs. } 48$

Contribution (25% of Rs. 48) = Rs. 12

Loss of contribution p.a. on reduced sales of 2,000 units p.m.

$= 2000 \text{ units} \times 12 \text{ months} \times \text{Rs. } 12 = \text{Rs. } 2,88,000$

Net saving = Rs. 12,96,000 — Rs. 2,88,000 = Rs. 10,08,000

Cost sheet

Problem 41. The expenses of a machine cost centre for a particular month are as under :

- (i) Power—Rs. 50,000 ; (ii) Maintenance and Repairs—Rs. 10,000;
 (iii) Machine Operator's Wages—Rs. 2,000 ; (iv) Supervision—Rs. 6,000 ; (v) Depreciation—Rs. 10,000.

Other particulars are given below :

Products	Rate of Production	Production Units
A	30 Units per hour	1,800
B	10 Units per hour	500
C	6 Units per hour	300
D	4 Units per hour	260

The entire production was to be offered to Government on 'Cost Plus 20%' basis. Material costs per unit are, A—Rs. 40, B—Rs. 60, C—Rs. 100 and D—Rs. 300.

Prepare a statement showing productwise 'cost' and 'offer price'.

Solution**Cost of Machine Centre**

Power	Rs. 50,000
Maintenance and repairs	10,000
Machine operators wages	2,000
Supervision	6,000
Depreciation	40,000
Total	1,08,000

Statement of Cost

Product	Output		Equivalent machine hours	Machine centre cost		Cost per unit	Material cost per unit		Total cost per unit
	Total	Per hour		Per hr.	Total allocation				
A	1,800	30	60	Rs.	Rs. 28,800	Rs. 16	Rs. 40		Rs. 56
B	500	10	50		24,000	48	60		108
C	300	6	50		24,000	80	100		180
D	260	4	65		31,200	120	300		420
			625		480*				1,08,000

*108000 ÷ 225 = 480 per hour

Statement of 'offer price'

Product	Cost per unit	Profit per unit @ 20% of cost	Offer price per unit
A	Rs. 56	Rs. 11.20	Rs. 67.20
B	108	21.60	129.60
C	180	36.00	216.00
D	420	84.00	504.00

Labour Turnover

Problem 42. (i) What is meant by the term 'Labour Turnover'? What is the effect of labour turnover on cost of production?

(ii) From the following data given by the Personnel Department calculate the labour turnover rate by applying.

- Separation Method
- Replacement Method
- Flux Method

No. of workers on the payroll :

At the beginning of the month	900
At the end of the month	1100

During the month 10 workers left, 40 persons were discharged and 150 workers were recruited. Of these, 25 workers are recruited in the

vacancies of these leaving, while the rest were engaged for an expansion scheme.

Solution : (i) Please refer to "*Advanced Cost and Management Accounting—Text*" by Saxena and Vashist.

Solution. (ii) Avg. number of workers = $(900 + 1100) \div 2 = 1,000$

Labour Turnover Rate

(a) Separation method

$$= \frac{\text{No. of separations during the period}}{\text{Average No. of workers in the same period}} \times 100$$

$$= \frac{10 + 40}{1000} \times 100 = 5\%$$

(b) Replacement method

$$= \frac{\text{No. of workers replaced during the period}}{\text{Average No. of workers in the same period}} \times 100$$

$$= \frac{25}{1000} \times 100 = 2.5\%$$

(c) Flux method

$$= \frac{\text{No. of separations} + \text{No. of replacements}}{\text{Average of workers in the period}} \times 100$$

$$= \frac{50 + 25}{1000} \times 100 = 7.5\%$$

B.E. Analysis

Problem 43. The executives of B Co., a small manufacturer of one product, are developing the annual profit plan. They have just reviewed the "first cut" at the annual income statement and are concerned with the Rs. 1,10,000 indicated profit on a sales volume of 20,000 units. The fixed cost structure of Rs. 9,90,000 appears to be high and they have some doubts about departing from the unit sales price of Rs. 100. There is a general agreement that the "profit target should be Rs. 2,20,000". This case deals with several tentative alternatives suggested during the meeting of the executive's committee that just reviewed the tentative profit plan.

You are required to compute.

- The budgeted breakeven point in rupees and in units and the number of units that would have to be sold to earn the target profit,
- You are also required to respond directly to each of the following two alternatives under consideration by the management. (Consider each independent of the other and state any assumptions that you would like to make.)

Alternative (1)—A sales price increase of 20% is contemplated; the sales executive estimates that this will cause a drop in units that can be sold by 15%. What would be the new breakeven point in rupees and in

units. What would be the new profit figures ? How many units would have to be sold to earn the target profit ?

Alternative (2)—A decrease in fixed costs of Rs. 55,000 and a decrease of variable costs 6% are contemplated. What would be new B.E.P. in rupees ? How many units must be sold to earn a target profit ?

Solution. (a) We know that $S - V = F + P$; find out variable cost from the given data

Sales volume (units)	20,000	
	<i>Total</i>	<i>Per Unit</i>
Sales	Rs. 20,00,000	Rs. 100.00
Fixed Cost	9,90,000	49.50
Profit	1,10,000	5.50
Contribution	11,00,000	55.00
Variable Cost	9,00,000	45.00

$$P/V \text{ Ratio} = \text{Contribution} / \text{Sales} \times 100 = 55\%$$

$$\text{B.E. Sales in units} = \text{Fixed cost} \div \text{Contribution per unit} \\ = \text{Rs. } 9,90,000 \div 55 = 18,000 \text{ units}$$

$$\text{B.E. Sales in Rupees} = 18,000 \text{ units} \times \text{Rs. } 100 = \text{Rs. } 18,00,000$$

$$\begin{array}{r} \text{Target Profit} \quad \quad \quad \text{Rs. } 2,20,000 \\ \text{Fixed cost} \quad \quad \quad \underline{\text{Rs. } 9,90,000} \end{array}$$

$$(x) \text{ Target contribution} \quad \quad \quad \underline{12,10,000}$$

Number of units to be sold

$$\begin{aligned} &= \text{Target contribution} \div \text{Contribution per unit} \\ &= \text{Rs. } 12,10,000 \div \text{Rs. } 55 = 22,000 \text{ units} \end{aligned}$$

(b) **Alternative (1).**

$$20\% \text{ increase in price} = \text{Rs. } 100 + 20 = \text{Rs. } 120$$

$$\text{Less Variable cost per unit} \quad \quad \quad \underline{45}$$

$$\text{Contribution per unit} \quad \quad \quad \underline{75}$$

$$\text{B.E. Point} = \text{Rs. } 9,90,000 \div \text{Rs. } 75 = 13,200 \text{ units}$$

$$\text{B.E. Sales} = 13,200 \times \text{Rs. } 120 = \text{Rs. } 15,84,000$$

$$\begin{array}{r} \text{New Profit figure with 15\% reduction in sales is} \quad \quad \quad 17,000 \text{ units} \\ \text{Contribution (17,000} \times \text{Rs. } 75) \quad \quad \quad \text{Rs. } 12,75,000 \\ \text{Less : Fixed cost} \quad \quad \quad \underline{9,90,000} \end{array}$$

$$\text{New Profit} \quad \quad \quad \underline{\underline{2,85,000}}$$

$$\begin{aligned} \text{No. of units to be sold to earn target contribution of Rs. } 12,10,000 \\ \text{as at (x)} &= \text{Target contribution} \div \text{Contribution per unit} \\ &= \text{Rs. } 12,10,000 \div 75 = \text{Rs. } 16,133 \end{aligned}$$

Alternative (2)

Revised Fixed Cost = Rs. 9,35,000

Revised variable cost per unit Rs. 45 less 6% 42.30

Revised contribution per unit = Rs. 100 - Rs. 42.30 = 57.70

B.E. Sales = Revised Fixed Cost ÷ Revised Contribution Ratio
= Rs. 9,35,000 ÷ 0.5770 = Rs. 16,20,451

Target Profit Rs. 2,20,000

Revised Fixed Cost 9,35,000

Revised Contribution 11,55,000

No. of units to be sold = Rs. 11,55,000 ÷ Rs. 57.70 = 20,017 units

Flexible Budget

Problem 44. The manager of a Repairs and Maintenance Department in response to a request, submitted the following budget estimates for his department that are to be used to construct a flexible budget to be used during the coming budget year ;

Details of cost	Planned at 6,000 Direct Repair Hours	Planned at 9,000 Direct Repair Hours
Employee salaries	Rs. 30,000	Rs. 30,000
Indirect repair materials	40,200	60,300
Miscellaneous cost etc.	13,200	16,800

(a) Prepare a flexible budget for the department up to activity level of 10,000 repair hours (use increments of 1,000).

(b) What would be the budget allowance at 8,500 direct repair hours ?

Solution. Analysis of each item of cost into fixed and variable

1. Employees cost : Same amount at both activity levels—fixed.
2. Indirect repair materials : Cost per repair hour is the same, i.e., Rs. 6.70 at both activity levels—Variable.
3. Miscellaneous Costs : Cost per repair hour—Rs. 2.20 at 6,000 level and cost per repair hour—Rs. 1.87 at 9,000 level—Semi-variable
 Variable = (Rs. 16,800 - 13,200) ÷ (9,000 - 6,000) or Rs. 1.20
 Fixed = Rs. 16,800 - (9,000 × 1.20) = Rs. 6,000

Total Fixed Cost = Rs. 30,000 + Rs. 6,000 = Rs. 36,000

Total Variable cost per unit = Rs. 6.70 + Rs. 1.20 = Rs. 7.90

<i>Controllable Costs</i>	<i>6,000 D.R.H.</i>	<i>7,000 D.R.H.</i>	<i>8,000 D.R.H.</i>	<i>9,000 D.R.H.</i>	<i>10,000 D.R.H.</i>
Employees salaries (Fixed)	Rs. 30,000	Rs. 30,000	Rs. 30,000	Rs. 30,000	Rs. 30,000
Indirect Rep. materials (V)	40,200	46,900	53,600	60,300	67,000
Miscellaneous costs etc. (SV)	13,200	14,400	15,600	16,800	18,000
	<u>83,400</u>	<u>91,300</u>	<u>99,200</u>	<u>1,07,100</u>	<u>1,15,000</u>

(c) Budget allowance for 8,500 Direct Repair Hrs.
 $= (7.90 \times 8,500) + 36,000 = \text{Rs. } 1,03,150$

Make or Buy

Problem 45. Stoner Company uses three different components (materials) in manufacturing its primary product. Stoner manufactures two of the components and purchases one (designated as Component 1) from outside suppliers. The Company is currently developing the annual profit plan. Sales are highly seasonal, Component 2 cannot be acquired from outsiders; however Component 3 can be purchased. The three Components have critical specifications. The annual profit plan provided data for the following computations :

	<i>Component 3 unit cost (at 12,000 units)</i>
Material (direct)	Rs. 1.40
Labour (direct)	2.20
Fixed overhead (apportioned)	0.40
Annual machine rental (special machine used only for Component 3)	0.50
Variable factory overhead	1.00
Average storage cost per year (fixed)	0.40
Total	<u>5.90</u>

Average inventory level 500 units.

The purchase manager investigated outside suppliers and found one that would sign a one year contract to deliver "12,000 top quality units as needed during the year at Rs. 5.20 per unit". Serious consideration is being given to this alternative. Should Stoner make or buy Component 3? Explain the relevant factors influencing your decision.

Solution. Variable cost :

Material (direct)	Rs. 1.40
Labour (direct)	2.20
Annual machine rental (sp. machine used only for Component 3)	0.50
Variable factory overhead	1.00
	<u>5.10</u>

Fixed Cost :

Fixed overhead (apportioned)	0.40
Average storage cost per year	0.40
	<hr/> 0.80
Total	<hr/> 5.90

If the component is made in own factory of Stoner, the variable cost is Rs. 5.10 per unit as against Rs. 5.20 offered by outside supplier. It is advisable to make. It is assumed that fixed cost will not change in the long run. Secondly, labour cost has been treated as *variable*, which seems to be misnomer. If it is decided to purchase the component from outside supplier, it may *not* be possible to dispense with the labour force due to labour legislation. In case labour cost is treated as fixed, revised cost will be Rs. 2.90, i.e., (Rs. 5.10—Rs. 2.20), which is *less* than purchase price. Hence, it is advisable to make the component.

Variance Analysis—Miscellaneous

Problem 46. From the following data of A Co. Ltd. relating to budgeted and actual performance for the month of March '87, compute the Direct Materials Direct Labour Cost Variances.

Budgeted data for March :

Units to be manufactured	1,50,000
Units of direct Material required (based on standard rates)	4,95,000
Planned Purchase of Raw Materials (units)	5,40,000
Average Unit Cost of Direct Material	Rs. 8
Direct Labour Hours per unit of finished goods	3/4 hr.
Direct Labour Cost (total)	Rs. 29,92,500

Actual data at the end of March :

Units actually manufactured	1,60,000
Direct Material Cost (purchase cost based on units actually issued)	Rs. 43,41,900
Direct Material Cost (purchase cost based on units actually purchased)	45,10,000
Average unit cost of Direct Material	8.20
Total Direct Labour hours for March	1,25,000
Total Direct Labour Cost for March	33,75,000

Solution.

M ₁ —Actual cost of material used (given)	Rs. 43,41,900
M ₂ —Standard cost* of material ($AQ \times SR$) [1,60,000 \times 3,309375 \times Rs. 8]	42,36,000
M ₃ —Not applicable in this case	
M ₄ —Standard material cost of output (1,60,000 \times 3.30 @ \times Rs. 8)	= 42,24,000

Variances

	Rs.
Material Price Variance = $M_1 - M_2$	Rs. 1,05,900 A
Material Wage Variance = $M_2 - M_4$	Rs. 12,000 A
Material Cost Variance = $M_1 - M_4$	Rs. 1,17,900 A
*Actual Material used per unit of finished product = [Rs. 43,41,900 ÷ 1,60,000] ÷ Rs. 8.20 = 3.309375	
@Standard R.M. consumption per unit of finished product = 4,95,000 units ÷ 1,60,000 = 3.30 units.	
L ₁ —Actual payment made to workers for actual hours worked	Rs. 33,75,000
L ₂ —Payment involved if workers had been paid at standard rate ($AH \times SR$) 125,000 hrs. × 26.60*	= Rs. 33,25,000
L ₃ —Not applicable in this case	
L ₄ —Std. labour cost of output achieved (Std. labour cost per unit × Actual Production) Rs. 19.95 @ × 1,60,000	= 31,92,000

Variances

Labour Rate Variance = $L_1 - L_2$	= Rs. 50,000 A
Labour Efficiency Variance = $L_2 - L_4$	= Rs. 1,33,000 A
Labour Cost Variance = $L_1 - L_4$	= Rs. 1,83,000 A
*Rs. 29,92,500 ÷ (1,50,000 × 0.75) .	
@ Rs. 29,92,500 ÷ 1,50,000	

Equivalent Production

Problem 47. (a) What is meant by equivalent production ?

(b) RP Ltd. furnishes you the following information relating to process B for the month of October '88 :

- (i) Opening Work-in-Progress—Nil.
- (ii) Units introduced—10,000 units @ Rs. 3/- per unit.
- (iii) Expenses debited to the process :
 - Direct materials—Rs. 14,650 ;
 - Labour—Rs. 21,148 ;
 - Overheads—Rs. 42,000.
- (iv) Normal loss in process—One per cent of input,
- (v) Closing Work-in-Progress—350 units—Degree of Completion :
 - Material—100%
 - Labour and Overheads—50%
- (vi) Finished Output—9,500 units
- (vii) Degree of Completion of abnormal loss :
 - Material—100%
 - Labour and Overheads—80%
- (viii) Units scrapped as normal loss were sold at Re. 1 per unit.
- (ix) All the units of abnormal loss were sold at Rs. 2.50 per unit.

Prepare

- (1) Statement of Equivalent production ;
- (2) Statement of Cost of Finished goods, Abnormal loss and Closing Work-in-Progress.

Solution.

(a) Please refer to "Advanced Cost and Management Accounting —Text." by Saxena and Vashist.

(b) **Statement Showing Equivalent Production**

Input units	Details	Output units	Equivalent Production			
			Materials Qty.	%.	Labour & Overheads Qty.	%.
10,000	Normal Loss (1%)	100	—	—	—	—
	Abnormal Loss	50	50	100%	40	80%
	Finished	9,500	9,500	100%	9,500	100%
	C/Stock	350	350	100%	175	50%
10,000		10,000	9,900		9,715	

Statement of Cost of Each Element

Element of Cost	Cost	Equivalent Production	Cost per unit
Materials			
Cost of units introduced	Rs. 30,000		
Direct materials	14,650		
	44,550		
Less : Sale of normal scrap	100		
	44,550	9,900	Rs. 4.50
Labour	21,148	9,715	2.17684
Overhead	42,000	9,715	4.3232

Statement of Apportionment of Cost

Items	Elements	Equivalent Production	Cost per unit	Cost	Total Cost
Introduced and completed	Material	9,500	Rs. 4.50	42,750	1,04,500
	Labour	9,500	2.17684	20,680	
	Overhead	9,500	4.3232	41,070	
Abnormal wastage	Material	50	4.50	225	485
	Labour	40	2.17684	87	
	Overhead	40	4.3232	173	

C/Stock	Material	350	4.50	1,575	
	Labour	175	2.17684	381	
	Overhead	175	4.3232	757	
				--	2,713
					1,07,698

Problem 48. (By-Product costing) (a) How would you deal with by-products in costing :

- (i) Where they are of small total value ?
 - (ii) Where they are of considerable total value ?
 - (iii) Where they require further processing ?
- (b) The yield of a certain process is 80% as to the main product, 15% as to the by-product and 5% as to the process loss. The material put in process (5,000 units) cost Rs. 23.75 per unit and all other charges are Rs. 14,250, of which power cost accounted for 33⅓%. It is ascertained that power is chargeable as to the main product and by-product in the ratio of 10 : 9.

Draw up a statement showing the cost of the by-product.

(C.A. Inter May, 1988)

Solution. (a) Please refer to "Advanced Cost and Management Accounting—Text by V.K. Saxena & C.D. Vashist.

(b) *Working Notes :*

Yield for 5,000 input units

	Yield in %	Yield in Units
Main product	80%	4,000
By product	15%	750
Process loss	5%	250

Statement showing distribution of Cost

Element	Total	Main Product	By-product	Remarks
Material	Rs. 1,18,750	Rs. 1,00,000	Rs. 18,750	M. Cost borne by 4,750 units
Other Charges (⅓ of Rs. 14,250)	9,500	8,000	1,500	borne by 4,750 units
Power (⅓ of Rs. 14,250)	4,750	2,500	2,250	in the given ratio of 10 : 9
Total Cost		1,10,500	22,500	

I.C.W.A. FINAL DECEMBER, 1988

Quoting for an Order (Relevant Cost Concept)

Problem 49! B. Ltd. is having a big plant where tailor made jobs are carried out. Recently a customer has approached them for a

job as per specifications supplied. B. Ltd. does not want to lose the customer and is ready to quote a lower price. The planning engineer was asked to prepare an estimate of material requirements as per the specifications. The cost estimates worked out are as under :

(1) Steel sheets 5,000 kg. at Rs. 15 per kg.	Rs. 75,000
(2) Steel rods 1,000 kg. at Rs. 10 per kg.	10,000
(3) Bearing hardware items, etc.	15 000
(4) Employees Costs :	
Monthly rated-grade A 400 hours at Rs. 10	4,000
Monthly rated-grade B 600 hours at Rs. 8.	4 800
(5) Overheads :	
Fabrication shop 500 hours at Rs. 20	10,000
Welding shop 300 hours at Rs. 40	12,000
Planning Engineers 200 hours at Rs. 15	3,000
Design Engineers 100 hours at Rs. 15	1,500
Total estimated cost	<u>1,35,300</u>

Following additional information is available.

(1) The stocks of steel sheets are more than sufficient and were purchased a year ago. Present market price of this item is Rs. 12 per kg.

(2) The steel rods were purchased five years back at Rs. 10 per kg. Present purchase price is Rs. 18 per kg. This material is already declared as non-moving and can be sold in market as such at Rs. 15 per kg. or can be substituted for alloy steel rods which are presently costing Rs. 17 per kg.

(3) The labour force is always moved from job to job depending on urgency. It is likely that the above job, if accepted, will have to be done by grade A workers alone.

(4) The fabrication shop is treated as profit centre. A transfer price of Rs. 20 per hour is used for charging to other shops in the workshop. The fabrication shop also done jobs for outsiders whom Rs. 25 per hour are charged. The transfer price fixed by welding shop is Rs. 40 per hour. The transfer prices are calculated as under :

		<i>Fabrication</i>	<i>Welding</i>
Variable cost per machine hour	Rs.	7	16
Departmental Fixed Costs	Rs.	6	20
Profit	Rs.	7	4
Transfer Price	Rs.	<u>20</u>	<u>40</u>

(5) The hourly rates of planning/design engineers are Rs. 10 per hour. However, for outside consultancy work, it is a practice to charge Rs. 15 per hour.

The management wants to have the bare minimum cost for the job so that the opportunity of getting the order is not lost.

- Revise the cost estimate using the additional information. Give reasons for each of the revised figure used in your calculations.
- Briefly state the applicability of opportunity cost approach and its implications in practical situations.
- Do you think that opportunity cost is relevant in a situation of alternate choice or make or buy decisions?

Solution. (a) Statement showing Revised Cost Estimates

(1) Steel sheets @ Rs. 12/kg. × 5,000 kg.	Rs. 60,000
(2) Steel rods 1,000 kg. @ Rs. 17/kg.	17,000
(3) Bearing, hardware items, etc.	15,000
(4) Labour Cost	Nil
(5) Overheads :	
Fabrication shop 500 hrs @ Rs. 25	12,500
Welding shop 300 hrs. @ Rs. 16	4,800
Planning engineers cost	Nil
Design engineers cost	Nil
Total estimated relevant cost	<u>1,09,300</u>

Relevant costs are estimated future cost pertinent to a decision. Imputed costs do not form part of relevant costs. All costs accumulated for stock valuation purposes may not be relevant cost.

Reason for Variation in the Cost Elements

- Current rate of steel sheets is quite relevant. Past rate of Rs. 12 per kg. has no impact on the decision and therefore not adopted in the cost estimates.
- Steel rods purchased five years ago cannot be used (non-moving) and as such it represents sunk cost. This material can now be substituted for alloy steel rods (Rs. 17/kg.). Alloy rods are cheaper than steel rods and, therefore, relevant to the decision.
- Fixed cost are past costs, not relevant to the decision. Labour costs are fixed in nature.
- It is assumed that Fabrication shop is working at optimum level. Therefore rate charged from outsiders (Rs. 25 per hour) is relevant.
- It is assumed that welding shop is not working at full capacity. Therefore variable cost of Rs. 16 per machine hour is adopted.
- Planning and design engineers costs are fixed cost and therefore, irrelevant.

For part (b) and (c) please refer to "Advanced Cost and Management Accounting—Text" (Chapter 11—Short-term Decision Making) by Saxena and Vashist.

Make or Buy (Relevant Cost Concept)

Problem 50. Chakra Ltd. manufactures Mixer Grinders. The manufacture involves an assembly of various parts which are processed in the machine shop and purchased components. The on/off switch is presently being purchased from a vendor at Rs. 4.50 each, annual requirement being 20,000 pieces.

The production manager has put up a proposal two months back to make the switch in the machine shop. He had suggested that the company will make profit and save taxes on bought-out switch. The costing department was asked to make an estimate of making the item which showed that the cost of making was Rs. 4.73. The purchase department continued buying the item on the basis of the cost estimate given to them. Recently, the vendor has sent a letter requesting the purchase department to grant increase in price by 10% minimum per switch as the input costs had gone up. The costing department was once again requested to estimate cost of making the switch.

The costing department re-estimated the costs using current prices and observed that the cost of making has gone up to Rs. 5.33. Purchase department again decided to continue buying as it was cheaper to buy than make. The cost estimates prepared by the costing department were as under :

	<i>Annual Costs</i>	
	<i>Previous</i>	<i>Current</i>
Direct Materials	Rs. 40,000	Rs. 48,000
Direct Labour Rs. 2 per hour	20,000	22,000
Overheads at Rs. 3 per hour	30,000	31,500
Total cost at current prices	90,000	1,01,500
Add : expected increase 5%	4,500	5,075
Expected manufacturing cost	94,500	1,06,575
Cost per piece	4.73	5.33
Twenty-five per cent of the overheads are fixed.		

Required : Do you agree with the decision of buying considering the relevant costs ? If the cost of making or buying is more or less same, what factors other than cost will influence the making decision ?

Solution. Fixed costs are referred to as sunk costs for decision making and, therefore, irrelevant. In make or buy decisions, fixed cost should not be considered as these costs are committed in the past and are unavoidable today. Therefore, fixed cost should be excluded from the cost to make. The relevant costs for the two periods are as under :

Details	Annual Costs	
	Previous	Current
Direct Materials	Rs. 40,000	Rs. 48,000
Direct Labour	20,000	22,000
Overheads (75% Variable)	22,500	23,525
Total cost at current price	82,500	93,625
Production (pieces)	10,000	20,000
Relevant cost per piece to make	4.13	4.68
Cost of Buying	4.50	4.95

The decision of purchase department to buy the switch from a vendor is not correct as the costs of making for both the periods are less than the costs by buying. The company should opt for making the switch in the own factory.

Note. Following costs are considered irrelevant for the two periods :

	Previous	Current
Overheads (25 % Fixed)	Rs. 7,500	Rs. 7,875
Expected increase	4,500	5,075
Total irrelevant cost	12,000	12,950
Irrelevant cost per piece	0.60	0.65

As the decision has to be taken at a particular point of time, expected increase in cost is not relevant to decision-making. On the other hand, there may also be similar increase in the buying cost.

For non-cost considerations in pricing decisions, please refer to Chapter 13 of "Advanced Cost and Management Accounting—Text" by Saxena and Vashist.

Key Factors

❖ **Problem 51.** Lacquer Painters undertake painting jobs of cars, scooters, buses etc. The paint materials of desired shades are purchased from market and then painted by spray gun in paint shop by skilled painters. The budget for next year is given below :

Paint Materials 100 kilolitres	Rs. 15,00,000
Direct Labour 25,000 hours	5,00,000
Variable overheads for 25,000 hours	10,00,000
Total Variable Costs	30,00,000
Fixed overheads	20,00,000
Total expected costs	50,00,000
Profit 25%	12,50,000
Expected job work revenue	62,50,000

The firm always faces problems in getting paint materials from markets as the customer needs only a particular shade. The skilled labour is also sometimes not available due to rush of jobs.

A customer wants to get his moped painted urgently. It is estimated that one litre paint is sufficient for painting the moped. Four labour hours will be required to complete the job. Required :

(1) What should be the painting charges if fixed costs are absorbed on the basis of variable costs and profit at 25% on total cost ?

(2) What should be the charges in case the paint material is a limiting factor ?

(3) What should be the charges in case the skilled labour is a limiting factor ?

(4) Which price out of above three would you recommend to the customer and why ?

(5) Would your answer to (4) above differ if the customer has no urgency ?

Solution. (1) **Total painting charges for a moped if fixed costs are absorbed on the basis of variable costs.**

Paint material (1 lt × Rs. 15)	Rs. 15'00
Direct labour (4 hrs × Rs. 20)	80'00
Variable overheads (4 hrs × Rs. 40)	160'00
Total variable costs	255'00
Fixed overhead (2/3rds of total variable costs)	170'00
Total cost	425'00
Profit (25% of total cost)	106'25
Total painting charges	531'25

(2) and (3)

	<i>Limiting factors</i>	
	<i>Paint Material</i>	<i>Skilled Labour</i>
Variable Cost	Rs. 255'00	255'00
Contribution per litre	32'50*	520'00*
Total painting charges	287'50	775'00
*Expected job work revenue		Rs. 62,50,000
Less : Variable Costs		30,00,000
Contribution for 1,00,000 litre		32,50,000
Contribution per litre		Rs. 32'50
@ Contribution for 25,000 hours		32,50,000
Contribution per 1 hour		Rs. 130
Contribution for 4 hours		520

(4) If the work has to be completed on urgent basis, the recommend painting charge will be Rs. 775 per moped as skilled labour force cannot be recruited at short notice.

(5) If there is *no* urgency, the painting charge will be Rs. 287.50 provided desired labour hours are available for completing the job.

Cost plus Pricing

Problem 52. A company has developed two types pocket T.V. sets operated on battery and having liquid crystal display. Model 'Sunny' is having single channel and model 'Delux' is having multi-channels. The management of the company asked their accountant to recommend prices for these new products which will fetch a margin of 20% on price. The accountant has collected following data for 1st year of production.

	<i>Sunny</i>	<i>Delux</i>
(1) Maximum Production and Sale/units	2,500	1,500
(2) Variable Cost per unit :		
Direct Materials	Rs. 300	Rs. 500
Direct Labour	100	200
(3) Attributable fixed overheads Rs. lacs	2.5	3.0
(4) Labour Hours per unit	20	40
(5) Machine Hours per unit	30	15

The marketing department is contemplating to sell the entire output produced during the year. The other common fixed overheads relating to these products are Rs. 8.58 lacs per annum. The management wants to have a statement of costs, revenue and profit for both the products. The accountant, accordingly, prepared two statements, one with common fixed costs absorbed on labour hour basis and another with common fixed costs absorbed on machine hour basis. However, he is not able to decide as to which one is correct for deciding price of the products. Required :

(a) Present the statement showing annual costs, revenue and profit for each product using both the bases that were used by the accountant for absorbing common fixed overheads.

(b) Which set of prices would you recommend ?

(c) Do you think that cost plus pricing decision is valid for a newly developed product ?

Solution. (a) Statement showing cost, revenue and profit for each product.

Common F.O. recovered on :	<i>Labour Hour</i>		<i>Machine Hour</i>	
	<i>Sunny</i>	<i>Delux</i>	<i>Sunny</i>	<i>Delux</i>
Maximum production/ Sales (units)	<u>2,500</u>	<u>1,500</u>	<u>2,500</u>	<u>1,500</u>

<i>Variable Cost:</i>	<i>Rs. Per Unit</i>			
Direct material	300	500	300	500
Direct labour	100	200	100	200
Attributable F.O.	100	200	100	200
Common F.O.*	156	312	264	132
Total Cost	656	1,212	764	1,032
Profit 20% on price or 25% on cost	164	303	191	258
Selling price per unit	820	1,515	955	1,290
*Total Labour Hours/				
Machine Hours				
	50,000	60,000	75,000	22,500
	1,10,000		97,500	
Total common fixed overhead	Rs. 8,58,000		Rs. 8,58,000	
(a) Overhead recovered per unit based on L.H.	Rs. 156	312		
(a) Overhead recovered per unit based on M.H.			264	132
(a)	7.8×20	7.80×40	8.8×30	8.8×15
(b) Contribution per unit	Rs. 420	815	555	590
Contribution per labour hour	21	20.38		
Contribution per machine hour			18.5	39.33

As the total contribution on both bases of overhead recovery is the same (Rs. 22.73), one has to resort to profit earned under both the bases. Under labour hour basis, the profit from both the models works out to Rs. 467 as compared to profit of Rs. 449 under machine hour bases. If, however, there is some limiting factor, price based on machine hour is recommended.

(c) Please refer to "Advanced Cost and Management Accounting—Text" by Saxena and Vashist for merits and demerits of Cost plus pricing.

Accepting/Rejecting an Export Order

Problem 53. A company which works at a capacity utilisation of 60% expects its turnover for the year 1988-89 at Rs. 86.40 lacs. If the company works at 100% capacity, the sales-cost relationship will be as made :

Factory Cost : Two-thirds of sales value

Prime cost : 75% of Factory Cost

Selling & Administration Expenses (75% variable) : 20% of Sales Value.

The Factory Overheads will vary according to the Operating Capacity in the following manner :

Operating Capacity	60%	80%	100%	120%
Factory Overheads				
(Rs. lacs)	19.80	21.60	24.00	30.00

The Company receives an offer from abroad for a value of Rs. 19·80 lacs. The Prime Cost of this order is estimated at Rs. 12 lacs and the selling and administration expenses applicable to this order is Rs. 90,000. This order will occupy 40% of the capacity of the Plant.

The Marketing Director estimates that by the time the new order materialises, the Company's own sales will increase to 80% of the capacity. Required : Prepare Statements to show

- (i) Profitability at the present capacity utilisation of 60%.
- (ii) Profitability based on the Marketing Director's estimates of increase in the Company's own sales to 80% capacity.
- (iii) Evaluation of the export order with advice as to whether the Company should accept the export order or not.

Solution : At 60% capacity utilisation, expected sales = Rs. 86·40 lakhs. At 100% capacity utilisation, sales = Rs. 140·00 lakhs. The various relationships are given only for 100% capacity utilisation. From these, variable elements can be found out :

	<i>At 100% capacity</i>
Sales at 100% capacity	= Rs. 144·00 lakhs
Factory Cost (2/3 of sales)	= 96·00
Prime Cost (75% of Fy. cost)	= 72·00
Factory Overheads (given)	= 24·00
Selling and Admn. Expenses—Variable	= 21·60
(20% of sales) —Fixed	= 7·20
Total cost of sales (Fy. cost + selling)	<u>124·80</u>
	<i>At 60% Capacity</i>
Sales (given)	86·40
Prime cost (Variable) $(72 \div 144) \times 86·40 =$	43·20
Factory Overheads	19·80
Factory cost	<u>63·00</u>
Selling and Admn. Costs—Variable	12·96
—Fixed	7·20
Total Cost of Sales	<u>83·16</u>
	<i>At 80% Capacity</i>
Sales $(144 \div 100) \times 80$	115·20
Prime Cost—Variable $(72 \div 100) \times 80$	57·60
Factory Overheads (given)	21·60

Factory Cost	79.20
Selling and Admn. Costs—Variable	17.25
—Fixed	7.20
Total Cost of sales	103.68
	<i>At additional 40% for export order</i>
Sales	19.80
Prime cost	12.00
Factory overheads (F.O. at 100% less F.O. at 88%)*	8.40*
Factory Cost	20.40
Selling and Admn.	0.90
Cost of Sales	21.30

*Semi-variable in nature. Fixed portion of factory overheads should not have been charged to export order.

Profitability (Rs. in lakhs)

	<i>Sales</i>	<i>Cost of Sales</i>	<i>Profit/Loss</i>
100%	144.00	124.80	19.20
60%	86.40	83.16	3.24
80%	115.20	103.68	11.52
40%	19.80	21.30	(1.50)

*(Additional)

From the above computation, it is clear that export order should not be accepted. However, if fixed portion of factory overheads is excluded, it will turn out to be profitable and hence accepted.

Product Mix

Problem 54. A Company manufactures four products. The Cost data per unit are as under :

	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>
Selling Price	Rs. 90	71	100	86
Direct Materials	30	20	40	40
Direct Labour	24	18	30	12
Variable Overheads	12	9	15	6

The fixed costs are estimated at Rs. 2,00,000 per month. The company employs 250 direct workers, who work eight hours a day for 25 days a month. The direct wage rate is Rs. 6 per hour. It is not possible for the company to increase its operatives in the short run nor is it practicable to work overtime. The Company's policy does not allow subcontracting of work.

The Marketing Director has forecast the following demand for a month :

<i>Product</i>	<i>Units</i>
<i>A</i>	5,500
<i>B</i>	5,000
<i>C</i>	6,250
<i>D</i>	8,250

The management desires you to revise the product mix in the following manner :

- to yield the maximum profit for the month.
- in proportion to the quantities forecast by the Marketing Director.
- in proportion to the labour requirements calculated for the forecast of sales of the Marketing Director.

Present statements showing the sales, costs and profits in respect of each of the aforesaid product mix.

Solution : Total direct labour hours = $250 \times 25 \text{ days} \times 8 \text{ hrs} = 50,000$

<i>Products</i>	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>
Direct labour cost per unit Rs.	24	18	30	12
Wage rate per hour	6	6	6	6
Direct labour hrs per unit	4	3	5	2
Selling Price	90	71	100	86
Less : Variable costs	66	47	85	58
Contribution per unit	24	24	15	28
D.L. Hours per unit	4	3	5	2
Contribution per D.L. Hour	6	8	3	14
Ranking	III	II	IV	I

- (a) The maximum direct labour hours are 50,000 and would be utilised in the following order :

<i>Product</i>	<i>Product-mix</i>	<i>D.L.H. per unit</i>	<i>Labour Hours</i>	<i>Contribution per D.L.H.</i>	<i>Total contribution</i>
<i>D</i>	8,250	2	16,500	14	Rs. 2,31,000
<i>B</i>	5,000	3	15,000	8	1,20,000
<i>A</i>	4,625*	4	18,500 (balance)	6	1,11,000
			50,000		4,62,000
	Less Fixed Overheads				2,00,000
				Profit	2,62,000

* $18,500 \div 4 = 4625$

(b) Product-mix in proportion to the quantities forecast by the Marketing Director
(Maximum D.L.H. 50,000).

Product	Demand	% to total	D.L.H.	D.L.H. Per unit	Product Mix	Contribution per unit	Total contribution
A	5,500	22	11,000	4	2,750	24	Rs. 66,000
B	5,000	20	10,000	3	3,333	24	79,992
C	6,250	25	12,500	5	2,500	15	37,500
D	8,250	33	16,500	2	8,250	28	2,31,000
	<u>25,000</u>	<u>100</u>	<u>50,000</u>		<u>16,833</u>		<u>4,14,492</u>
					<u>Less Fixed overheads</u>		<u>2,00,000</u>
							<u>2,14,492</u>

Profit

(c) Product-mix in proportion to the labour requirements calculated for the forecast of Sales
(Maximum L.H. 50,000)

Product	Demand	D.L.H.	Total D.L.H.	%	D.L.H. available	Product Mix	Contribution per unit	Total Contribution
A	5,500	4	22,000	25.96	12,930	3,245	24	Rs. 77,880
B	5,000	3	15,000	17.70	8,850	2,950	21	79,992
C	6,250	5	31,250	36.87	18,335	3,687	15	57,605
D	8,250	2	16,500	19.47	9,735	4,867	28	1,36,276
	<u>25,000</u>		<u>84,750</u>	<u>100.00</u>	<u>50,560</u>			<u>3,40,261</u>
					<u>Less Fixed Overheads</u>			<u>2,00,000</u>

For question on Transfer Pricing, please refer to Problem 13.24 of Chapter 13.

Standard Cost Operating Statement

Problem 55. X Ltd. produces and sells a single product. The Company carries no stocks of materials, finished goods or work-in-progress. Its standard costs were revised at the end of 19X1 for the new accounting year to 31st December 19X2, as follows :

	19X1 Standard	(Rs.)	19X2 Standard	(Rs.)
Direct Materials	6 kgs @ Rs. 3 per kg	18	6 kgs @ Rs. 3.5 per kg.	21.0
Direct Labour	5 hrs @ Rs. 4 Per hr	20	4.5 hrs @ Rs. 5 per hr.	22.5
Production Variable Overhead	5 hrs @ Rs. 1 per hr	5	4.5 hrs @ Rs. 1.4 per hr.	6.3
Production Fixed Overhead	5 hrs @ Rs. 2 per hr	10	4.5 hrs @ Rs. 2.4 per hr.	10.8
		53		60.6
Sale Price		60		66.0
Standard Profit		Rs. 7		Rs 5.4

The budget in each year was to make and sell 24,000 units uniformly distributed per month.

The Actual results of June 19X1 and June 19X2 were exactly the same as follows :

Actual Results in both period—June 19X1 and June 19X2

Sales (2,000 units)	Rs.	Rs. 1,20,000
Cost of Production and Sales :		
Direct Materials (12,600 kg)	36,540	
Direct Labour	38,400	
Production Variable Overhead	11,520	
Production fixed overhead	22,000	1,08,460
Profit		11,540

The Operating Statement of June 19X1 was as follows :

Budget Profit (2,000 units @ Rs. 7)	Rs.	Rs. 14,000
-------------------------------------	-----	------------

Variances :

Materials Price	1,260 (F)
Materials Usage	1,800 (A)
Labour Efficiency	1,600 (F)
Variable Overheads	1,520 (A)

Fixed Overheads :

Expenditure	2,000 (A)	
Efficiency	800 (F)	
Capacity	800 (A)	2,460 (A)
		<hr/>
Actual Profit		Rs. 11,540

You are required :

- (a) to present the variances for June 19X2 in a similar operating statement.
- (b) The production manager must decide whether or not to investigate the material usage variance in June 19X2. He believes that there is a 0.3 probability that the variance is controllable but the cost of investigating the matter would be Rs. 90 and a further Rs. 120 would be incurred if control action is found to be necessary. Determine what must be the minimum expected benefits from control action to justify investigation of the material usage variance ?

Solution. Workings—19X2

M ₁ —Actual cost of material used	Rs. 26,540
M ₂ —Standard cost of material used (12,600 units × Rs. 3.50)	44,100
M ₃ —not applicable	
M ₄ —Standard material cost of output (2,000 × 6 × Rs. 3.50)	42,000

Variances

Material Price Variance = M ₁ - M ₂	7,560 F
Material Usage Variance = M ₂ - M ₄	2,100 A
L ₁ —Actual payment made to workers for actual hours worked	38,400
L ₂ —Payment involved if workers had been paid at Standard rate *9,600 hours ÷ 5 *38,400 ÷ 4	48,000
L ₃ and L ₄ —N.A.	
L ₅ —Standard labour cost of output achieved (Std. labour cost per unit × Std. production) 2,000 × Rs. 22.5	45,000
Labour rate variance L ₁ - L ₂	9,600 F
Labour efficiency variance L ₂ - L ₅	3,000 A
V ₁ —Actual Overhead incurred during the period	11,500
V ₂ —N.A.	
V ₃ —Std. Variable Overhead for production (2,000 × 4.5 hrs × Rs. 1.40)	12,600
Variable Overhead Variance V ₁ - V ₃	1,080 F

For Fixed Overheads Variances

FO ₁ —Actual F.O. incurred	22,000
FO ₂ —Budgeted F.O. for the period 9,000 hrs × 2.4	21,600
FO ₃ —N.A.	

FO ₄ —F.O. for actual hours worked at Std. rate 9,600 hrs. \times 2.4	23,040
FO ₅ —Std. F.O. for production $2,000 \times 4.5 \times 2.4$	21,600

Variance :

F.O. Expenditure Variance FO ₁ —FO ₃	400 A
F.O. Capacity Variance FO ₂ —FO ₄	1,440 F
F.O. Efficiency Variance FO ₄ —FO ₅	1,440 A

Sales Value Variance :

SV ₁ —Actual value of sales realised	1,20,000
SV ₂ —Std. Value of actual sales ($2,000 \times 66$)	1,32,000
Sales value price variance SV ₁ —SV ₂	12,000 A
(There are no other sales value variances)	

Operating Statement For June 19X2

Budgeted profit ($2,000 \times \text{Rs. } 5.4$)	Rs. 10,800
Sales Price Variance	12,000 A

Variances :

Material Price	7,560 F	
Material Usage	2,100 A	
Labour rate	9,600 F	
Labour Efficiency	3,000 A	
Variable Overhead	1,080 F	
Fixed Overhead Variances :		
Expenditure	400 A	
Capacity	1,440 F	
Efficiency	1,440 A	
	— — —	12,740 F
Actual Profit		11,540

Let i = cost of investigation ; b = benefit of control action $i = 0.3 b$
or Rs. 90 = $0.3 b$ or b = Rs. 300 (Minimum)

Net saving = Rs. 300 after deducting control cost or Rs. 420 before deducting control cost.

For question on probability and expected profit please refer to Problem 15.23 of chapter 15.

For question on Maximin and Minimax criteria and pay off matrix, please refer to Problem 15.24 of Chapter 15.

Continue Operation or Lease the Building—Application of total project approach incremental (relevant approach) and opportunity cost approach.

Problem 56. (a) The Z Company owns and operates a chain of 25 stores. Budgeted data for the Garden store are as follows.

Annual Sales	Rs. 4,25,000
Annual cost of goods sold and other operating expenses.	3,82,000
Annual building ownership costs (not included above)	20,000

The company can lease the building to a large flower shop for Rs. 4,000 per month. Decide whether to continue operations of this store or to lease using.

- (i) The total project (or comparative statement) approach.
- (ii) The incremental (or relevant cost) approach.
- (iii) The opportunity cost approach.

Accepting an Order (Relevant Cost)

(h) Although the Ajoy Company has the capacity to produce 16,000 units per month, current plans call for monthly production and sales of only 10,000 units Rs. 15 each. Costs per unit are as follows :

Direct materials	Rs. 5'00
Direct labour	3'00
Variable factory overhead	0'75
Fixed factory overhead	1'50
Variable selling expense	0'25
Fixed administrative expense	1'00

Rs. 11'50

- (i) Should the Company accept a special order for 4,000 units at Rs. 10 per unit ?
- (ii) What is the maximum price the Company should be willing to pay an outside supplier who is interested in manufacturing this product ?
- (iii) What would be the effect on the monthly contribution margin if the sales price was reduced to Rs. 14 resulting in a 10% increase in sales volume ?

Solution. (a)

- (i) Comparative statement showing the profitability of two alternatives

	Continue operation	Lease the building
Annual sales	Rs. 4,25,000	Rs. 48,000 (@ Rs. 4,000 p.m.)
Less : Cost of goods sold (excluding ownership costs)	3,82,000	
Building ownership costs	20,000	20,000
Net income	23,000	28,000

Net income is Rs. 28,000 if the building is leased out and thus leasing is a profitable proposition.

- (ii) Incremental (or relevant cost) approach

Building ownership costs not relevant as there is no change in these costs under both the alternatives. Therefore the correct approach will be to consider the incremental cash inflows from continuing the operation.

Net cash flow from continuing the operation

(Rs. 4,25,000 — 3,82,000)=43,000

Less : Income from leasing 48,000

Incremental loss from continuing operations (5,000)

Therefore, company should *not* continue the operation.

(iii) The Opportunity Cost Approach.

Total sale revenue Rs. 4,25,000

Less : Cost of goods sold 3,82,000

Opportunity cost of leasing 48,000

Loss due to continue operation 5,000

Therefore, company should lease out the building.

(b) (i) Selling price per unit Rs. 10.00

Less : Variable Costs

Direct material Rs. 5.00

Direct labour 3.00

Variable F.O. 0.75

Variable selling expense 0.25

9.00

Contribution per unit 1.00

The company should accept a special order of 4,000 units at Rs. 10 per unit as it yields contribution of Rs. 8 per unit. Idle capacity can also be utilised to the extent of 4,000 units. It is assumed that variable selling expenses are incurred for special order too.

(ii) If this product is not manufactured in one own factory and the same is purchased from outside supplies, the company should be willing to pay Rs. 8.75 per unit. It is assumed that resultant spare capacity can be utilised for other product and there will be no change in fixed overheads. Labour cost is strictly treated as variable and variable selling expenses will *not* be incurred in case of "Buying Decisions".

(iii) If the selling price is reduced to Rs. 14 per unit.

Sales 10,000 units 11,000 units

Contribution period (Rs. 15—9)=Rs. 6 Rs. 14—9=Rs. 5

Total Contribution Rs. 60,000 Rs. 55,000

Reduction in total contribution
if the proposal is accepted Rs. 5,000

For question on Probabilistic Budget, please refer to Problem 15.24 in Chapter 15.

For question on "Inflation Accounting, please refer to Problem 14.7 in Chapter 14.

Labour (Executive Compensation Scheme)

Problem 57. Happystaff Ltd., in order to motivate its executives had introduced at the beginning of 1986 a scheme of Executive compensation package. The details as regards the cadre of Sales Managers is as under :

- (a) Basic Pay—Sales Managers are fixed in the Time Scale Rs. 2,000—1,00—Rs. 2,500—EB—150—Rs. 4,000. Annual increments are automatic and the Efficiency Bar will be invoked only in the case of gross misconduct or neglect of duty.
- (b) Fringe benefits—Free furnished accommodation, laundry service, telephone etc., the value of which will be adjusted to 30% of the Basic Pay.
- (c) Every Sales Manager having earned a profit before Taxes will receive a bonus equivalent of 1% of any Sales increase over the previous years level. In the event of a sales decrease, no bonus will be paid and the following year's bonus will be calculated using the sale of the year preceding the decline as a base figure.
- (d) There will be a return on investment bonus to every Sales Manager. For this purpose, return is defined as Earnings before Interest and Tax : and investment, the total of net Fixed Assets and Current Assets. For ascertaining the bonus, the return on investment will be multiplied by a performance factor which will be determined as per the following scale :

<i>Size of Investment Rs.</i>	<i>Value of performance Factor Rs.</i>
0 — 5,00,000	15,000
5,00,000 — 10,00,000	19,000
10,00,000 — 15,00,000	26,500
15,00,000 and above	30,000

You are required to calculate the annual enrolments package of Sales Manager, Southern Area for each of the 4 years 1985 to 1988. His basic pay as on 1.1.1985 was Rs. 2,400 per month.

The following data from the books of Happystaff Ltd. are relevant:] :

	(Rs. '000)			
	1985	1986	1987	1988
Sales	Rs. 590	Rs. 647	Rs. 600	Rs. 720
Material	236	258	238	280
Labour	118	139	130	145
Expenses	98	102	100	108
Interest	48	40	52	60
Income Tax	40	50	41	52
Net Profit	50	58	39	75

Balance Sheet Summary

Fixed Assets Net of Depreciation	895	840	900	930
Current Assets	115	110	120	141
	<u>1010</u>	<u>950</u>	<u>1020</u>	<u>1071</u>
Share Capital	300	300	300	300
Reserves	30	70	90	30
Loan	600	520	550	700
Current Liabilities	80	60	80	41
	<u>1010</u>	<u>950</u>	<u>1020</u>	<u>1071</u>

Solution.**Basic Pay :**

1985	Rs. 2,400 p.m.	Rs. 28,800 p.a.
1986	2,500 p.m.	30,000 p.a.
1987	2,650 p.m.	31,800 p.a.
1988	2,800 p.m.	33,600 p.a.

Fringe Benefits ;

1985	30% of 28,800	Rs. 8,640 p.a.
1986	30% of 30,000	9,000 p.a.
1987	30% of 31,800	9,540 p.a.
1988	30% of 33,600	10,080 p.a.

Sales Bonus :

1985	Nil	
1986	(647—590), i.e., 57,000	@1% Rs. 570 p.a.
1987	Nil	
1988	(720—647) i.e. 73,000	@1% Rs. 730 p.a.

Investment Return Bonus

1985	Nil
1986	$1,48,000 \div 950,000 \times 19,000 = 14,800 \div 5 = 2960$
1987	$1,32,000 \div 10,20,000 \times 25,500 = 3300$
1988	$1,87,000 \div 10,71,000 \times 25,500 = 93,500 \div 21 = 4452$

Annual Emoluments Package of Sales Manager-Southern Area

	1985	1986	1987	1988
Basic pay	Rs. 28,800	Rs. 30,000	Rs. 31,800	Rs. 33,600
Fringe Benefits	8,640	9,000	9,540	10,080
Sales Bonus	—	570	—	730
Investment Return Bonus	—	2,960	3,300	4,452
TOTAL	<u>37,440</u>	<u>42,530</u>	<u>44,640</u>	<u>48,862</u>

C.S. Inter June 1988

For Question 1 of part A (Product Mix) please refer to Problem 9-56 at page 9-108.

For Question 3 of Part A (Apportionment of Overheads between production departments and service departments), please refer to Problem 3-4 at page 3-6.

Problem 58-(Machine Hour Rate)

- (a) Define machine hour rate and discuss its advantages over the other methods.
 (b) The following particulars relate to a new machine purchased :

	Rs.	
Purchase price of the machine	4,00,000	
Installation expenses	1,00,000	
Rent per quarter	15,000	
General lighting for the total area	1,000	per month
Foreman's salary	30,000	per annum
Insurance premium for the machine	3,000	per annum
Estimated repair for the machine	5,000	per annum
Estimated consumable stores	4,000	per annum
Power—2 units per hour at Rs. 50 per 100 units.		

The estimated life of the machine is 10 years and the estimated value at the end of the 10th year is Rs. 1 lakh. The machine is expected to run 20,000 hours in its life time. The machine occupies 25% of the total area. The foreman devotes 1/6 of his time for the machine.

Calculate the machine hour rate for the machine.

Solution (a) Please refer to "Advanced Cost and Management Accounting-text" by Saxena and Vashist.

(b) Calculation of Machine hour rate

Standing charges.

Rent for the year (1/4th share for this machine)	=	Rs. 15,000	Rs
Lighting (Rs 12,000 + 4) for one year	=	3,000	
Foreman's Salary (Rs 30,000 + 6)	=	5,000	
Insurance Premium	=	3,000	

Depreciation:

Cost of machine Rs. 4,00,000

Add Installation charges 1,00,000

5,00,000

Less Residual Value

after 10 years 1,00,000

4,00,000

For one year (4,00,000 ÷ 10) = 40,000
66,000

No. of hours worked during the year 2000
 Hourly rate of standing charges 33-00
 (Rs. 66,000 ÷ 2,000 hrs)

Operating charges—

Consumable stores per hour (Rs 4000 ÷ 2000) 2-00

Repair per hour (Rs. 5000 ÷ 2000) 2-50

Power per hour (2 units × Re 0-50) 1-00

Machine hour rate 38-50

C. S. Inter December 1988

Problem 59. (Appropriation of Overheads). A wholesale company which sells four products believes some of them to be unprofitable and is considering eliminating the sale of one of them. The following information is available regarding its income, costs and activities for the year :

	<i>PRODUCT</i>			
	A	B	C	D
Sales (Rs.)	30,000	50,000	25,000	45,000
Cost of production (Rs.)	20,000	45,000	21,000	22,500
Area of storage (Sq. mtrs.)	5,000	4,000	8,000	3,000
Number of parcels sent	10,000	15,000	7,500	17,500
Number of invoices sent	8,000	14,000	6,000	12,000
Its overhead costs and basis of allocation are:				
<i>Fixed costs</i>	<i>Rs.</i>	<i>Basis of allocation to products</i>		
Rent	3,000	Sq. mtr.		
Insurance	100	Sq. mtr.		
Depreciation	1,000	Parcel		
Salesmen's salaries and expenses	6,000	Sales volume		
Administrative wages and salaries	5,000	No. of invoices		
<i>Variable costs</i>				
Packing wages and materials		0.25 paise per parcel		
Commissions		4% of sales		
Clerical materials		0.05 paise per invoice		

You are required to:

- (i) Prepare an analysis of the total overhead costs of each product;
- (ii) Prepare a profit and loss statement showing percentage profit or loss to sales for each product; and
- (iii) Compare the profit if the company were to eliminate product B with what it would be if they eliminated product C instead.

Solution:

Product	A Rs	B Rs.	C Rs.	D Rs.	Total Rs.
<i>Variable Cost:</i>					
Packing Wages & materials (a) 0.25 per parcel.	2,500	3,750	1,875	4,375	12,500
Commission 4% of Sale	1,200	2,000	1,000	1,800	6,000
Clerical materials Re 0.5 per invoice	<u>400</u>	<u>700</u>	<u>300</u>	<u>600</u>	<u>2,000</u>
	<u>4,100</u>	<u>6,450</u>	<u>3,175</u>	<u>6,775</u>	<u>20,500</u>
<i>Fixed Costs :</i>	<i>Basis</i>				
Rent	Sq. Mtr.	750	600	1,200	3,000
Insurance	Sq. Mtr.	25	20	40	100
Depreciation	Parcel	200	300	150	1,000
Salesmens' Salaries & exp.	Sales value	1,200	2,000	1,000	6,000
Adm. wages & Salaries.	No of Invoices	<u>1,000</u>	<u>1,750</u>	<u>750</u>	<u>5,000</u>
		<u>3,175</u>	<u>4,670</u>	<u>3,140</u>	<u>15,100</u>
Total Overheads.	<u><u>7,275</u></u>	<u><u>11,120</u></u>	<u><u>6,315</u></u>	<u><u>10,890</u></u>	<u><u>35,600</u></u>

Profit & Loss Statement

Sales	<u>30,000</u>	<u>50,000</u>	<u>25,000</u>	<u>45,000</u>	<u>1,50,000</u>
Cost of Production	20,000	45,000	21,000	22,500	1,08,500
Variable Cost	<u>4,100</u>	<u>6,450</u>	<u>3,175</u>	<u>6,775</u>	<u>20,500</u>
Marginal Cost	<u>24,100</u>	<u>51,450</u>	<u>24,175</u>	<u>29,275</u>	<u>1,29,000</u>
Contribution	5,900	(1450)	825	15,725	21,000
Fixed Cost	<u>3,175</u>	<u>4,670</u>	<u>3,140</u>	<u>4,115</u>	<u>15,100</u>
Profit (loss)	<u>2,725</u>	<u>(6,120)</u>	<u>(2,315)</u>	<u>11,610</u>	<u>5,900</u>
% of profit or loss to Sales.	9.08% (12.24%)		(9.26%)	25.8%	3.93%

(c) If product B is eliminated :

Profit = (21,000 + 1,450) – 15,100 = Rs. 7,350

If product C is eliminated:

Profit = (21,000 – 825) – 15,100 = Rs. 5,075

Problem. 60 (Direct Material Variances). The standard mix of product A2 is as follows:

Kgs.	Material	Price per kg. (Rs.)
45	X	6.00
25	Y	4.50
30	Z	9.50

The standard loss in production is 10% of input. There is no scrap value. Actual production for a month was 7,425 kgs. of A2 from 80 mixes. Actual purchases and consumption of material during the month were :

Kgs.	Material	Price per kg. (Rs.)
4,200	X	6.50
1,700	Y	4.25
2,600	Z	9.75

You are required to calculate the following variances for presentation to the management :

- (i) Material cost variance; (ii) Material price variance; (iii) Material mix variance; (iv) Material yield variance.

Solution.

For Material Cost Variances

M₁—Actual Cost of material used

Material	Kgs.	Price per kg.	Amount
X	4,200	Rs. 6.50	27,300
Y	1,700	4.25	7,225
Z	<u>2,600</u>	9.75	<u>25,350</u>
	<u>8,500</u>		<u>59,875</u>

M₂— Standard Cost of material used

Material	Kgs.	Price per kg.	Amount
X	4,200	Rs. 6.00	Rs. 25,200
Y	1,700	4.50	7,650
Z	<u>2,600</u>	9.50	<u>24,700</u>
	<u>8,500</u>		<u>57,550</u>

M₃—Standard Cost of material, if it had been used in standard proportion.

X	(45 + 100) × 8500	×	Rs. 6.00	=	Rs. 22,950.00
Y	(25 + 100) × 8500	×	4.50	=	9,562.50
Z	(30 + 100) × 8500	×	9.50	=	<u>24,225.00</u>
					<u>56,737.50</u>

M₄—Standard Material Cost of Output.

Cost of 90 kgs. of output as per standard

	kgs.				
X	45	×	Rs. 6.00	=	Rs. 270
Y	25	×	4.50	=	112.50
Z	<u>30</u>	×	9.50	=	<u>285.00</u>
	100				<u>667.50</u>
Less loss 10%	<u>10</u>				
Output	<u>90</u>	kg			

Standard Cost of Material

For output of 7425 kg.

X	(Rs. 270 + 90) × 7425	=	Rs. 22,275.00
Y	(Rs. 112.50 + 90) × 7425	=	Rs. 9,281.25
Z	(Rs. 285 + 90) × 7425	=	<u>23,512.50</u>
			<u>55,068.75</u>

(i) Material Price Variance (M₁ - M₂)

For Mat. X	Rs 27300 - Rs. 25200	=	Rs 2100	(A)
For Mat. Y	Rs 7225 - Rs. 7650	=	425	(F)
For Mat. Z	Rs 25350 - 24700	=	<u>650</u>	(A)
			<u>2325</u>	(A)

(ii) Material Mix Variance (M₂ - M₃)

For Mat. X	Rs 25200 - Rs. 22950	=	Rs. 2250.00	(A)
For Mat. Y	Rs 7650 - Rs. 9562.50	=	1912.50	(F)
For Mat. Z	Rs 24700 - Rs. 24225.00	=	<u>475.00</u>	(A)
			<u>812.50</u>	(A)

(iii) Material Yield Variance (M₃ - M₄)

For Mat. X	Rs. 22950 - Rs. 22275	=	675.00	(A)
For Mat. Y	Rs. 9562.50 - Rs. 9281.25	=	281.25	(A)
For Mat. Z	Rs. 24225.00 - Rs. 23512.50	=	<u>712.50</u>	(A)
			<u>1668.75</u>	(A)

(iv) Material Cost Variance (M₁ - M₄)

For Mat. X	Rs. 27300 - Rs. 22275	=	Rs. 5025.00	(A)
For Mat. Y	7225 - 9281.25	=	2056.25	(F)
For Mat. Z	25350 - 23512.50	=	<u>1837.50</u>	(A)
			<u>4806.25</u>	(A)

Total annual consumption	...	1,20,000 units
Purchase price (per unit)	...	Rs. 1-50
Ordering cost	...	Rs. 80 per order
Cost of carrying inventory	...	20% per annum

$$EOQ = \sqrt{\frac{2AB}{CS}} = \sqrt{\frac{2 \times 1,20,000 \times 80}{1.5 \times 0.20}} = \sqrt{\frac{1,92,00,000}{0.30}} = 8000 \text{ units}$$
CIMA London May 1989

Direct material X – 10 kilogrammes @ Rs. 20	Rs. 200
Direct material Y – 5 litres @ Rs. 6	30
Direct wages – 5 hours @ Rs. 6	30
Fixed production overhead	50
Total standard cost	310
Standard gross profit	90
Standard selling price	400

Sales on credit : 800 units at Rs. 400		Rs. 320,000
Direct material: X 7,800 kilogrammes	Rs.	159,900
Y 4,300 litres		23,650
Direct Wages: 4,200 hours		24,150
Fixed production overhead		<u>47,000</u>
		<u>254,700</u>
Gross profit		65,300

Wages paid during April (Net) Rs. 20,150.

Deductions from wages owing to the Inland Revenue for PAYE and NI were Rs.5,000 and the wages accrued for April were Rs. 5,000.

The fixed production overhead of Rs. 47,000 was made up of expense creditors of Rs. 33,000, none of which was paid in April, and depreciation of Rs. 14,000.

The company operates an integrated accounting system.

You are required to

- (a)
 - (i) calculate price and usage variances for each material,
 - (ii) calculate labour rate and efficiency variances,
 - (iii) calculate fixed production overhead expenditure, efficiency and volume variances;
- (b) show all the accounting entries in T accounts for the month of April—the work-in-progress account should be maintained at standard cost and each balance on the separate variance accounts is to be transferred to a Profit and Loss Account which you are also required to show;
- (c) explain the reason for the difference between the actual gross profit given in the question and the profit shown in your profit and loss account.

Solution : (a) *For Material Cost Variance.*

M₁—Actual Cost of Material Purchased.

X	—	9000 kgs. × Rs. 20.50	=	Rs. 1,84,500
Y	—	5000 lt × Rs 5 50	=	<u>27,500</u>
				<u>2,12,000</u>

M₂—Standard Cost of Material Purchased.

X	—	9000 kgs. × Rs. 20.00	=	Rs. 1,80,000
Y	—	5000 lt × Rs. 6.00	=	<u>30,000</u>
				<u>2,10,000</u>

M₃—Standard Cost of Material used :

X	—	7800 kg × Rs. 20	=	Rs 1,56,000
Y	—	4300 lt × Rs. 6	=	<u>25,800</u>
				<u>1,81,800</u>

M₄—Standard Material Cost of Production.

X	—	800 × 10 × Rs. 20	=	Rs. 1,60,000
Y	—	800 × 5 × Rs. 6	=	<u>24,000</u>
				<u>1,84,000</u>

Material Price Variance = M₁ – M₂

X	=	1,84,500 – 1,80,000 =	Rs. 4500 (A)
Y	=	27,500 – 30,000 =	<u>2500 (F)</u>
			<u>2000 (A)</u>

Note:—This is calculated at the time of purchase.

Material Usage Variance = M₃ – M₄.

X	—	Rs. 1,56,000 – Rs. 1,60,000	=	Rs 4000 (F)
Y	—	Rs. 25,800 – 24,000	=	<u>1800 (A)</u>
				<u>2200 (F)</u>

(ii) *For Direct Wage Variance:*

L₁—Actual payment made to workers for actual hours worked.

$$4200 \times \text{Rs. } 5.75 = \text{Rs. } 24,150$$

L₂—Payment involved if the workers had been paid at standard rate

$$4200 \text{ hrs} \times \text{Rs. } 6.00 = \text{Rs. } 25,200$$

L₃—Standard labour cost of output

$$800 \text{ units} \times \text{Rs. } 30 \text{ per unit} = 24,000$$

Direct Wage Rate Variance = L₁ – L₂

$$= \text{Rs. } 24150 - \text{Rs. } 25200 = \text{Rs. } 1050 \text{ (F)}$$

Direct Wage Efficiency Variance = L₂ – L₃ = Rs. 25,200 – 24,000

$$= \text{Rs. } 1200 \text{ (A)}$$

(iii) *For Fixed Overhead Variance*

FO₁ = Actual Fixed Overhead incurred = Rs. 47,000

FO₂ = Budgeted Fixed Overhead for the period

$$= (10800 + 12) \times \text{Rs. } 50 = \text{Rs. } 45,000$$

FO₃ = Nil

FO₄ = Fixed Overhead for actual hours worked at standard rate

$$4200 \text{ hrs} \times (\text{Rs. } 50 \div 5) = \text{Rs. } 42,000$$

FO₅ = Standard fixed Overhead for production

$$800 \text{ units} \times \text{Rs. } 50 = \text{Rs. } 40,000$$

Fixed Overhead Expenditure Variance = FO₁ – FO₂

$$= \text{Rs. } 47,000 - \text{Rs. } 45,000 = \text{Rs. } 2,000 \text{ (A)}$$

Fixed Overhead Capacity Variance = FO₂ – FO₄ then it will be

$$\text{Rs. } 45,000 - \text{Rs. } 42,000 = \text{Rs. } 3,000 \text{ (A)}$$

Fixed Overhead Efficiency Variance

$$= \text{FO}_4 - \text{FO}_5 = \text{Rs. } 42,000 - \text{Rs. } 40,000 = \text{Rs. } 2,000 \text{ (A)}$$

Fixed Overhead Volume Variance = FO₂ – FO₅

$$= \text{Rs. } 45,000 - \text{Rs. } 40,000 = \text{Rs. } 5,000 \text{ (A)}$$

(b)

Stores Control A/c

To K Ltd. – X	Rs. 184,500	By Mat. Price Variance–X	Rs. 4,500
" C.P. Ltd.–Y	27,500	By W.I.P. A/c	
" Mat. Price Variance–Y	2,500	X —	1,56,000
		Y —	25,800
		" Balance c/f	<u>28,200</u>
	<u>2,14,500</u>		<u>2,14,500</u>

Wages Control A/c

To Cash	20,150	By Balance b/f	6,000
" Deductions	5,000	" W.I.P. A/c	25,200
" D.W. Rate Variance	1,050		
" Balance c/d	<u>5,000</u>		
	<u>31,200</u>		<u>31,200</u>

Fixed Overhead Control A/c

To Creditors	Rs. 33,000	By W.I.P	Rs. 40,000
" Depreciation Provision	14,000	" Expenditure Variance	2,000
		" Capacity Variance	3,000
		" Efficiency Variance	<u>2,000</u>
	<u>47,000</u>		<u>47,000</u>

WIP Control A/c

To Stores Control		By Material usage Variance	1,800
X—	1,56,000	" Labour efficiency Variance	1,200
Y—	25,800	" Finished Goods Control A/c	
" Wages Control	25,200	800×Rs. 310	2,48,000
" Fixed off Control A/c	40,000		
" Material Usage Variance-X	<u>4,000</u>		
	<u>2,51,000</u>		<u>2,51,000</u>

Finished Goods Control

To WIP Control	<u>2,48,000</u>	By Cost of Sale	<u>2,48,000</u>
		Cost of Sales	
To F. Goods Control A/c	<u>2,48,000</u>	By Costing P&L A/c	<u>2,48,000</u>

Material Price Variance

To Stores Control—X	4,500	By Stores Control—Y	2,500
		" P&L A/c	<u>2,000</u>
	<u>4,500</u>		<u>4,500</u>

Material Usage Variance

To WIP—X	1,800	By WIP—Y	4,000
" P&L A/c	<u>2,200</u>		
	<u>4,000</u>		<u>4,000</u>

Labour Rate Variance

To P&L A/c	<u>1,050</u>	By Wages Control A/c	<u>1,050</u>
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Labour Efficiency Variance

To Wages Control A/c	<u>1,200</u>	By P&L A/c	<u>1,200</u>
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Fixed Overhead Expenditure Variance

To Fixed Overhead Control A/c Rs.	<u>2,000</u>	By P&L A/c	<u>2,000</u>
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Fixed Overhead Capacity Variance

To Fixed Overhead Control A/c	<u>3,000</u>	By P&L A/c	<u>3,000</u>
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Fixed Overhead Efficiency Variance

To Fixed Overhead Control A/c Rs.	<u>2,000</u>	By P&L A/c	<u>2,000</u>
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Sales

To Costing P&L A/c	<u>3,20,000</u>	By Debtors	<u>3,20,000</u>
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		K Ltd.	
		By Stores Control A/c	Rs. 1,84,500
		C Ltd.	
		By Stores Control A/c	27,500
		Expense Creditors	
		| By Fixed OH Control A/c	33,000
		Provision for Depreciation	
		| By Fixed OH Control A/c	14,000
		Profit & Loss A/c	
To Cost of Sales	Rs. 2,48,000	By Sales	Rs. 3,20,000
" Material Price Variance	2,000	" Material Usage Variance	2,200
" L. Efficiency Variance	1,200	" Labour Rate Variance	1,050
" F.O. H. Exp. Variance	2,000		
" F.O.H. Efficiency "	2,000		
" F.O.H. Capacity "	3,000		
" Balance (Gross Profit)	<u>55,050</u>		
	<u>3,23,250</u>		<u>3,23,250</u>

(c) The difference of Rs. 250 in the profit figures are due to different treatment of material Price Variance—calculation on Purchases or Wages. The additional Price Variance calculated in costing records are:

$$\text{Material -X (9000 kg - 7800 kg) } \times 0.50^{\oplus} = \text{Rs. 600.00 (A)}$$

$$\text{Material -Y (5000 kg - 4300 kg) } \times \text{Re 0.50}^{\#} = \text{350.00 (F)}$$

$$\text{Actual Profit minus Costing Profit} = \text{250.00 (A)}$$

\oplus Rs. 20.50 - Rs. 20.00 = Rs. 5.00 (A) & Rs. 5.50 - Rs. 6.00 = Re. 0.50 (F)

The actual closing stock must be Rs. 250 higher than the closing stock balance, which is valued at standard.

Note:— Readers should particularly note (i) that need for reconciliations exists even in "Integrated Accounting System" due to a peculiar situation. (ii) In Single Plan variances are calculated at different stages.

Problem 63. (Contract Costing—Unconventional approach in finding notional profit) To attract more tourists to a beautiful part of a country a contract has been awarded to Y p.l.c. to build an expressway road at an estimated price of Rs. 102 million which includes a budgeted profit of Rs. 27 million. The contract includes the building of slip roads and also a tunnel under a river in order to preserve the appearance of the nearby ancient town which is dominated by a castle. The time scale for the contract from start to finish is five years unless unforeseen difficulties arise.

Work commenced on 1 April 1986 and for the three-year period to 31 March 1989, the following data are available.

	Rs. '000
Invoice value of work certified to date	50,000
Progress payments received from customer	40,000
Cost :	
Planning, estimating and surveyors' fees	2,000
Materials delivered to sites	15,000
Materials returned from sites	500
Direct wages paid	8,000
Wage-related costs	1,000
Plant-hired	3,500
Sites office costs: rent and rates	156
salaries and related costs	1,200
Apportioned headoffice costs	750
Direct expenses incurred (insurance, bank interest etc)	1,804

The invoiced value of work certified to date includes all work to 31 March 1989 so cost of work not certified is nil.

Plant owned by the contractors bought specifically for this contract originally cost Rs. 8 million and has been in use almost continuously since the beginning of the contract and is expected to have a residual value of Rs. 500,000 at the end of the five-year contract. The straight-line method of depreciation is in use.

Cost of materials on sites at 31 March 1989 is estimated at Rs. 400,000.

Direct wages owed at 31 March 1989 were Rs. 55,000.

The contract is regarded by management to be approximately half complete and is expected to be completed on schedule. In the previous two financial years no profits were included in the company's accounts in respect of this particular contract but the directors would now like to show a profit which is appropriate to their estimate of the degree of completion of the contract as at 31 March 1989.

You are required to: (i) show the contract account for the three-year period to 31 March 1989; (ii) evaluate the work-in-progress including some profit, showing the basis and the reason(s) for your profit figure at 31 March 1989; and (iii) calculate one alternative profit figure to that given in your answer to (ii) above which ought to be acceptable to the directors.

Solution:

Contract Account (Rs in thousands)				
(i)	To Plant	8,000	By Plant c/f	3,500
	" Planning and estimating and Surreyor's fees	2,000	By materials returns	500
	" Material	15,000	" Material Output	400
	" Direct Wages	8,000	" Balance b/f	37,065
	" Wage related Costs	1,000		
	" Plant Hired	3,500		
	" Site Costs :—			
	Rent & taxes	156		
	Salaries & related Costs	1,200		
	H.O. Expenses	750		

D. Expenses	1,804		
D. Wages outstanding	<u>55</u>		
	<u>41,465</u>		<u>41,465</u>
(ii) To Balance b/f	37,065	By WIP c/f	50,565
" Profit	<u>13,500</u> ⊕		
	<u>50,565</u>		<u>50,565</u>
To WIP b/f	50,565		
" Plant b/f	3,500		
" Materials	400		

⊕ Rs. 27,000 × 0.5 (This is an unconventional approach based on hypothesis given in the question.)

The Contract is approximately half complete. Therefore half of the expected contract profit has been taken. Contract is expected to be completed on schedule. Therefore an 'objective' approach to profit reporting has been adopted. Based on convention approach the profit figure can be shown in number of ways and second part of contract a/c according to one of which will be as follows :—

(iii) To Balance b/f	Rs. 37,065	By Work Certified	Rs. 50,000
" P&L A/c	6,900		
" Reserve transfered to to P&L A/c	<u>6,035</u>		
	<u>50,000</u>		<u>50,000</u>

$$\text{Notional Profit Rs. } 12,935 \times \frac{2}{3} \times \frac{\text{Cash received}}{\text{Work certified}}$$

$$= 12,935 \times \frac{2}{3} \times \frac{40,000}{50,000} = \text{Rs. } 6898.67 \text{ or Rs. } 6900$$

Problem 64. (Causes of Sales Variances). Budgetary control and standard costing are used within an insurance company and a standard cost of Rs. 20 has been set for obtaining and issuing each new life policy.

Prior to the commencement of the annual financial period, the life business manager had forecast that 7,500 policies would be sold during the year and the Rs. 20 standard cost was based on the following budgeted costs for the department. Actual costs are also shown.

Code		Budget	Actual
301	Sales staff salaries	Rs. 30,000	Rs. 33,750
302	Sales staff commissions	30,000	28,500
303	Sales staff expenses	15,000	13,000
431	Salaries—underwriting staff	45,000	50,000
599	Other administration costs	<u>30,000</u>	<u>33,000</u>
		<u>150,000</u>	<u>158,250</u>

At the end of the year, it was ascertained that

1. 6,750 new life policies had been issued.
2. the sales staff and underwriting staff received as salaries pay award of 12½% which had been back-dated to the beginning of the year and this had not been included in the budget.
3. expenses on codes 302, 303 and 431 are regarded as direct costs which vary with activity, and those on code 301 are treated as a direct fixed cost whilst those on code 599 are an indirect fixed cost.

You are required to

- (i) present a statement (or control report) for the life business manager showing the variances which have arisen,
- (ii) comment on the likely cause or causes for each variance identifying, so far as you can from the information given, how much of each variance arises from price differences and how much can be related to efficiency or inefficiency.

Solution :

Code		Fixed Budget	Flexed Budget	Actual	Variances
		7500 units	6750 units	6750	
301	Sales Salaries	Rs. 30,000	Rs. 30,000	33,750	Rs. 3750 (A)
302	" Staff commission	30,000	27,000	28,500	1,500 (A)
303	" Staff expenses	15,000	13,500	13,000	500 (F)
431	" Underwriting Staff	45,000	40,500	50,000	9,500 (A)
599	" Other Adm. Costs	<u>30,000</u>	<u>30,000</u>	<u>33,000</u>	<u>3,000 (A)</u>
		<u>150,000</u>	<u>141,000</u>	<u>158,250</u>	<u>17,250 (A)</u>

(ii) *Sales Salaries*. Rs. 37,750 (A) Rate Variance is due to unanticipated pay award.

Sales Commission—Rs. 3000(F) is due to drop in activity and Rs. 1500 (A) may be due to increasing sales commission on selected policies or due to inefficiency.

Sales Expenses—Rs. 1500 reduction due to drop in activity and Rs. 500 (F) for improved control.

Underwriting Salaries — Rs. 4500 (F) due to drop in activity, Rs. 5062½(A) due to unbudgeted salary increases and Rs. 44138 (A) due to inefficiency.

Other Administration—Rs. 3000 (A) seem to have been caused by changes due to high cost suppliers or hiring temporary office staff.

Problem 65. (Limiting Factor and determining best selling prices using price-demand function) AB p.l.c. makes two products, Alpha and Beta. The company made a Rs. 500,000 profit last year and proposes an identical plan for the coming year. The relevant data for last year are summarised in Table 1.

Table 1: Actuals for last year

	Product	
	Alpha	Beta
Actual production and sales (units)	20,000	40,000
Total costs per unit	Rs. 20	Rs. 40
Selling price per unit (25% on cost)	Rs. 25	Rs. 50
Machining time per unit (hours)	2	1
Potential demand at above selling prices (units)	30,000	50,000

Fixed costs were Rs. 480,000 for the year, absorbed on machining hours which were fully utilised for the production achieved.

A new Managing Director has been appointed and he is somewhat sceptical about the plan being proposed. Furthermore, he thinks that additional machining capacity should be installed to remove any production bottlenecks and wonders whether a more flexible pricing policy should be adopted.

Table 2 summarises the changes in costs involved for the extra capacity and gives price/demand data, supplied by the Marketing Department, applicable to the conditions expected in the next period.

Table 2:

Costs

Extra machining capacity would increase fixed costs by 10% in total. Variable costs and machining times per unit would remain unchanged.

Price/demand data	Products	
	Alpha	Beta
Price range (per unit)	Rs. 20-30	Rs. 45-55
Expected demand ('000 units)	45-15	70-30

You are required to : (a) calculate the plan to maximise profits for the coming year based on the data and selling prices in Table 1.

(b) calculate the best prices and production plan based on the data in Table 2.

Solution : (a) *Statement showing computation of profit*

	Products		Total
	Alpha	Beta	
Actual production (units)	20,000	40,000	
Machining time per unit (Hours)	2	1	
Total Machining time required	40,000	40,000	80,000 hrs.
Fixed cost per annum		Rs. 480,000	
Absorption rate per hour			Rs. 6
Selling price per unit	Rs. 25	Rs. 50	
Less: Variable cost (20-12)	8 [⊕]	(40-6) 34 [⊕]	
Contribution	17	16	
Machining hours	2	1	
Contribution per machining hour	Rs. 8.50	Rs. 16	

⊕ V. Cost = Total Cost - F. Cost.

Therefore, company should first meet the maximum demand of Beta and use the balance of Alpha.

First maximum of Beta should be produced. It will use: 50,000 units \times 1 hr. = 50,000 hrs. Maximum hours are 80,000. Therefore balance 30,000 hours (i.e. 80,000 hrs – 50,000 hrs) should be used for producing Alpha.

Number of Alpha units to be produced will be: 30,000 hrs \div 2 = 15,000 units.

The profit as per this plan will be—

	Total Contribution
Beta 50000 units \times Rs. 16 =	8,00,000
Alpha 15000 units \times Rs. 17 =	<u>2,55,000</u>
	10,55,000
Fixed Cost	<u>4,80,000</u>
	<u>5,75,000</u>
Existing profit	Rs. 5,00,000

The Company should adopt the revised plan as it yields higher profit. Existing plan is thus not optimal.

(b) The price/demand relationship shown in *Note 2* is assumed to be linear.

(Differential calculus has been used)

	Alpha A	@	Beta B	@
Demand in '000 units				
Selling price per unit (derived from range given)	$P = 35^* - \frac{1}{3}A$ $P = 62.5^* - \frac{1}{4}B$			
Revenue	$= (35 - \frac{1}{3}A)A$ $= (62.5 - \frac{1}{4}B)B$ $= 35 - \frac{1}{3}A^2$ $= 62.5B - \frac{1}{4}B^2$			
\therefore Marginal revenues	$= 35 - \frac{2}{3}A$ $= 62.5 - \frac{1}{2}B$			
Optimum output (MR. = MC)	Rs. 8	$= 35 - \frac{2}{3}A$	Rs.	$= 62.5 - \frac{1}{2}B$
	$A = 40,500$ units $B = 57,000$ units			
Optimum price		$= 35 - \frac{1}{3}(40.5)$		$= 62.5 - \frac{1}{4}(57)$
		= Rs. 21.5		= Rs. 48.25

Notes : (i) The prices can also be obtained by linear interpolation of the price/demand relationships given in *Note 2*.

(ii) There is no need to calculate the profit arising from this production plan.

* Price range is given for an expected demand. This price is arrived at if demand is zero.

$$@ \frac{20 - 30}{45 - 15} = \frac{10}{30} \text{ or } \frac{1}{3};$$

$$\frac{45 - 55}{70 - 35} = \frac{10}{40} \text{ or } \frac{1}{4}$$

Problem. 66. (Life cycle costing for new investment) A2Z p.l.c. supports the concept of terotechnology or life cycle costing for new investment decisions covering its engineering activities. The financial side of this philosophy is now well established and its principles extended to all other areas of decision making.

The company is to replace a number of its machines and the Production Manager is torn between the Exe machine, a more expensive machine with a life of 12 years, and the Wye machine with an estimated life of 6 years. If the Wye machine is chosen it is likely that it would be replaced at the end of 6 years by another Wye machine. The pattern of maintenance and running costs differs between the two types of machine and relevant data are shown below.

	Exe	Wye
Purchase price	Rs. 19,000	Rs. 13,000
Trade-in value	3,000	3,000
Annual repair costs	2,000	2,600
Overhaul costs	(at year 8) 4,000	(at year 4) 2,000
Estimated financing costs averaged over machine life	10% p.a.	10% p.a.

You are required to: (a) recommend, with supporting figures, which machine to purchase, stating any assumptions made;

(b) describe life cycle costing and give the benefits that are likely to accrue from its use. Support your answer with examples of changes in practice that could occur from adopting this philosophy.

(a) Solution.

<i>Machine Exe—Life 12 years</i>				
Year	Cost	Discount Factor	Discounted Cost	
Purchase price	0	Rs. 19,000	1.00	Rs. 19,000
Overhead Cost	8	4,000	0.47	1,880
Trade-in value	12	(3,000)	0.32	(960)
Annual Repair Cost	1-12	2,000	6.81	<u>13,620</u>
				<u>33,540</u>

Annualised equivalent Rs. $33,540 \div 6.81 = \text{Rs. } 4,925$

<i>Machine Wye—Life 6 years</i>				
Year	Cost	Discount Factor	Discounted Cost	
Purchase Price	0	Rs. 13,000	1.00	Rs. 13,000
Overhead Cost	4	2,000	0.68	1,360
Trade in Value	6	(3,000)	0.56	(1,680)
Annual Repair Cost	1-6	2,600	4.36	<u>11,336</u>
				<u>24,016</u>

Annualised equivalent Rs. $24,016 \div 4.36 = \text{Rs. } 5,508$

Recommendation:—Purchase Exe

Assumptions (i) Same performance, capacity and speed.

(ii) No inflation

(iii) 12 year—estimates are as accurate as 6 year estimates

(iv) Cash flow at the year end.

- (b) Life cycle costing or terotechnology is defined as a combination of management, financial, engineering and other practices applied to physical assets in pursuit of economic life cycle costs, i.e., its aim is to obtain the best use of physical assets at the lowest total cost to the entity. This makes explicit the trade-off between higher capital costs and lower maintenance and running costs. The development of the "just-in-time" approach to manufacturing would also involve explicit consideration of machine downtime over its life, set-up costs and possible different quality costs for different plant choices. Examples of life cycle costing in practice can vary over all fields. For example.

Housing— insulation versus heating costs

Cars — Initial cost versus service frequency, rate of repair, rustproofing etc.

Industrial plants— Initial cost versus sustained accuracy, ease to set up etc.

For question on recommending transfer prices as a Group Management Accountant, please refer to problem 13-25

For question on Probabilistic CVP Analysis with inflation factor, please refer to problem 15-31

For question on Forecasting Contribution using linear regression, please refer to Problem 15-32

For question on Contribution Analyses with Joint probability and Projections for different price scenarios, please refer to Problem 15-33.

For question on Learning Curve Application to labour cost and project evaluation, please refer to problem 15-34

For the question on Learning Curve Application using Standard Formula, please refer to Problem 15-35

For question on Cost-price relationship using exponential functions, please refer to Problem 15-36

C.A. Inter May 1989

Problem 67. (Control Accounts) On 31st March, 1989 the following balances were extracted from the books of the SUPREME MANUFACTURING COMPANY :—

	Dr.	Cr.
	Rs.	Rs.
Stores Ledger Control A/c	35,000	
Work in Progress Control A/c	38,000	
Finished Goods Control A/c	25,000	
Cost Ledger Control A/c		<u>98,000</u>
	<u>98,000</u>	<u>98,000</u>

The following transactions took place in April 1989 :—

Raw Materials :—

Purchased	Rs. 95,000
Returned to suppliers	3,000
Issued to production	98,000
Returned to stores	3,000

Productive wages	40,000
Indirect labour	25,000
Factory overhead expenses incurred	50,000
Selling and Administrative expenses	40,000
Cost of finished goods transferred to warehouse	2,13,000
Cost of Goods sold	2,10,000
Sales	3,00,000

Factory overheads are applied to production at 150% of direct wages, any under/over absorbed overhead being carried forward for adjustment in the subsequent months. All administrative and selling expenses are treated as period costs and charged off to the Profit and Loss Account of the month in which they are incurred.

Show the following Accounts :

(a) Cost Ledger Control A/c; (b) Stores Ledger Control A/c; (c) Work in Progress Control A/c; (d) Finished Goods Stock Control A/c; (e) Factory Overhead Control A/c; (f) Costing Profit and Loss A/c; (g) Trial Balance as at 30th April, 1989.

Solution.

(a) Cost Ledger Control A/c			
To Store L.C. A/c	Rs. 3,000	By Balance b/f	Rs. 98,000
" Costing P&L A/c	300,000	" Store L.C. A/c	95,000
" Balance c/d	95,000	" Wages Control A/c	65,000
		" Factory O.H.C. A/c	50,000
		" Selling & Distribution exp.	40,000
		" Costing P&L A/c	50,000
	<u>398,000</u>		<u>398,000</u>
		By Balance b/f	95,000
(b) Stores Ledger Control A/c			
To Balance b/f	Rs. 35,000	By C.L. Control A/c	Rs. 3,000
" Cost Ledger Control A/c	95,000	" W.I.P A/c	98,000
" W.I.P A/c	3,000	" Balance c/d	32,000
	<u>133,000</u>		<u>133,000</u>
To Balance b/f	32,000		
(c) Work in Progress A/c			
To Balance b/f	Rs. 38,000	By Store L.C. A/c	Rs. 3,000
" Store L.C. A/c	98,000	" F.G. A/c	2,13,000
" Wages C. A/c	40,000	" Balance	20,000
" Factory O.H.C. A/c	60,000		
	<u>2,36,000</u>		<u>2,36,000</u>
" Balance b/f	20,000		
(d) Finished Goods Control A/c			
To Balance b/f	Rs. 25,000	By Cost of Sales A/c	Rs. 2,10,000
" W.I.P A/c	2,13,000	" Balance c/d	28,000
	<u>2,38,000</u>		<u>2,38,000</u>
" Balance b/f	28,000		

(e) Factory O.H. Control A/c			
To Wages C. A/c	Rs. 25,000	By W.I.P A/c	60,000
" Cost L.C. A/c	50,000	" Balance b/f	15,000
	<u>75,000</u>		<u>75,000</u>
(f) Cost P&L A/c			
To Cost of Sales A/c	Rs. 250,000	By Cost L.C. A/c	Rs. 3,00,000
" Cost Ledger Control A/c	50,000		
	<u>3,00,000</u>		<u>3,00,000</u>
(g) Trial Balance as on 30th April 1989			
Store Ledger control A/c	32,000		
Work in Progress A/c	20,000		
Finished Goods A/c	28,000		
Factory OH Control A/c	15,000		
Cost Ledger Control A/c	—		95,000
	<u>95,000</u>		<u>95,000</u>

Working Notes

(i) Wages Control A/c			
To Cost Ledger Control A/c	Rs. 40,000	By WIP	Rs. 40,000
" " "	25,000	" Factory OH Control A/c	25,000
	<u>65,000</u>		<u>65,000</u>

Selling & Distribution Expenses

To Cost Ledger Control A/c	Rs. 40,000	By Cost of Sales A/c	Rs. 40,000
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Cost of Sales A/c

To Finished Goods A/c	Rs. 2,10,000	By Costing Profit and Loss A/c	2,50,000
" Selling & Distribution Exp	40,000		
	<u>2,50,000</u>		<u>2,50,000</u>

Problem 68. (Direct Material Variances) GEMINI CHEMICAL INDUSTRIES provide the following information from their records:—

For making 10 kgs. of GEMCO, the standard material requirement is

Material	Quantity (kgs.)	Rate per kg. (Rs.)
A	8	6.00
B	4	4.00

During April 1988, 1000 kgs. of GEMCO were produced. The actual consumption of materials is as under:—

Material	Quantity (kgs.)	Rate per kg. (Rs.)
A	750	7.00
B	500	5.00

Calculate: (a) Material Cost Variance; (b) Material Price Variance; and (c) Material Usage Variance.

Solutions : For material cost variances :

M₁—Actual Cost of material used :

Material A 750 kg × Rs. 7.00	=	Rs. 5,250
Material B 500 kg × Rs. 5.00	=	<u>2,500</u>
1200 kg		<u>7,750</u>

M₂—Standard Cost of Material used :

Material A 750 kg × Rs. 6	=	Rs. 4,500
Material B 500 kg × Rs. 4	=	Rs. <u>2,000</u>
1200 kg		<u>6,500</u>

M₃—Standard Cost of Material if it had been used in standard proportion

Material A: (8 + 12) × 1200 × Rs. 6	=	Rs. 4,800
Material B : (4 + 12) × 1200 × 4	=	<u>1,600</u>
		<u>6,400</u>

M₄—Standard Material Cost of production

Cost of 10 kg of GEMCO:

A : 8 kg × Rs. 6	=	Rs. 48
B : 4 kg × Rs. 4	=	<u>16</u>
		<u>64</u>

$$\therefore (\text{Rs. } 64 + 10 \text{ kg}) \times 1,000 = 6,400$$

Material Cost Price Variance : M₁ – M₂

$$= \text{Rs. } 7,750 - \text{Rs. } 6,500 = \text{Rs. } 1,250 \text{ (A)}$$

Material Mix Variance = M₂ – M₃

$$= \text{Rs. } 6,500 - \text{Rs. } 6,400 = \text{Rs. } 100 \text{ (A)}$$

Material Usage Variance : M₂ – M₄

$$= \text{Rs. } 6,500 - \text{Rs. } 6,400 = \text{Rs. } 100 \text{ (A)}$$

Note :— In this problem material Cost Usage Variance includes only Material Cost Mix variance, since material cost quantity variance is zero.

Problem 69. (B.E. Analyses—Profit increase due to increase in sales) (A) The following figures are available from the records of VENUS ENTERPRISES as at 31st March:—

	1989 Rs. lakhs	1989 Rs. lakhs
Sales	150	200
Profit	30	50

Calculate :— (a) the P/V ratio and total fixed expenses; (b) the break-even level of sales; (c) sales required to earn a profit of Rs. 90 lakhs; (d) Profit or loss that would arise if the sales were Rs. 280 lakhs.

(B) What are the limitation of a break-even chart ?

$$\begin{aligned}\text{Solution. (A) P/V ratio} &= \frac{\text{change in profit}}{\text{change in sales}} \times 100 \\ &= \frac{\text{Rs. 50 lakhs} - \text{Rs. 30 lakhs}}{\text{Rs. 200 lakhs} - \text{Rs. 150 lakhs}} = 40\%\end{aligned}$$

We know that $S \times \text{P/V ratio} = F + P$

or $\text{Rs. 150 lakhs} \times 40\% = F + 30 \text{ lakhs}$ or Fixed expenses = Rs. 30 lakhs.

(b) $\text{BES} \times \text{P/V ratio} = \text{Fixed Cost}$

$\text{BES} \times 40\% = \text{Rs. 30,00,000}$

$\text{BES} = \text{Rs. 75,00,000}$

(c) $\text{Sales} \times \text{P/V ratio} = F + P$

or $\text{Sales} \times 40\% = \text{Rs. 30,00,000} + 90,00,000$

or $\text{Sales} = \text{Rs. 300,00,000}$

(d) $\text{Rs. 280,00,000} \times 40\% = \text{Rs. 30,00,000} + P$

or Profit = Rs. 82,00,000

(B) Please refer to "Advanced Cost and Management Accounting --Text" by Saxena and Vashist.

Problem 70. (Operating Cost of a tourist car) SHANKAR has been promised a contract to run a tourist car on a 20-km. long route for the chief executive of a multinational firm. He buys a car costing Rs. 1,50,000. The annual cost of insurance and taxes are Rs. 4,500 and Rs. 900 respectively. He has to pay Rs. 500 per month for a garage where he keeps the car when it is not in use. The annual repair costs are estimated at Rs. 4,000. The car is estimated to have a life of 10 years, at the end of which the scrap value is likely to be Rs. 50,000.

He hires a driver who is to be paid Rs. 300 per month plus 10% of the takings as commission. Other incidental expenses are estimated at Rs. 200 per month.

Petrol and oil will cost Rs. 100 per 100 kms. The car will make for round trips each day. Assuming that a profit of 15% on takings is desired and that the car will be on the road for 25 days on an average per month, what should he charge per round-trip?

Solution : Statement showing the Operating Cost of a tourist car

Standing Charges	Per annum	Per month
Insurance	Rs. 4,500	
Taxes	900	
Garage Rent	6,000	
Repairs	4,000	
Drivers Salary	3,600	
Incidental expenses	2,400	
Depreciation	<u>10,000</u>	
	31,400	<u>2,616-67</u>

Variable ExpensesPetrol and Oil 4,000[⊕] km × Re 14,000-00

Total Cost without commission

6,616-67Let x be the total takings per monthCommission 10% of x or say $0.10x$ Profit 15 % of x or say $0.15x$

Total takings per month = Total Cost + Commission + Profit

$$x = \text{Rs. } 6,616.67 + 0.10x + 0.15x$$

$$\text{or } x = \text{Rs. } 8,822.22$$

Number of round trips per month 25 days × 4 = 100

Charge per round trip = Rs. 8822.22 ÷ 100 = Rs. 88.22

[⊕] 20 km × 2 (Return) × 4 (Round trips) × 25 days = 4,000 km.

Problem 71. (FIFO and LIFO methods of Pricing Issues) The following information is provided by SUNRISE INDUSTRIES for the fortnight of April, 1988:—

Material Exe:

Stock on 1-4-1988 100 units at Rs. 5 per unit.

Purchases

5-4-88 300 units at Rs. 6

8-4-88 500 units at Rs. 7

12-4-88 600 units at Rs. 8

Issues

6-4-88 250 units

10-4-88 400 units

14-4-88 500 units

Required :—

(A) Calculate using FIFO and LIFO methods of pricing issues:

(a) the value of material consumed during the period

(b) the value of stock of materials on 15-4-88.

(B) Explain why the figures in (a) and (b) in part A of this question are different under the two methods of pricing of material issues used. You NEED NOT draw up the Stores Ledgers.

Solution : (A) Value of Material Exe consumed using FIFO

Date	Description	Qty	Rate	Amount	
1-4-88	Opening Stock	100 units	Rs. 5	Rs. 500	
5-4-88	Purchases	300	6	1,800	
6-4-88	Issues	100	5	500	} 1,400
		150	6	900	
8-4-88	Purchases	500	7	3,500	
10-4-88	Issues	150	6	900	} 2,650
		250	7	1,750	
12-4-88	Purchases	600	8	4,800	
14-4-88	Issues	250	7	1,750	} 3,750
		250	8	2,000	
15-4-88	Closing stock.	350	8	2,800	

(a) Value of Material consumed = Rs. 1,400 + 2,650 + 3,750 = 7,800

(b) Value of Closing Stock = Rs. 2,800.

Value of Material Exe Consumed Using LIFO

Date	Description	Qty.	Rate	Amount
1-4-88	Opening Stock	100 units	Rs. 5	Rs. 500
5-4-88	Purchases	300	6	1,800
6-4-88	Issue	250	6	1,500
8-4-88	Purchases	500	7	3,500
10-4-88	Issues	400	7	2,800
12-4-88	Purchases	600	8	4,800
14-4-88	Issues	500	8	4,000
15-4-88	Closing stock	350	—	2,300@

(a) Value of material consumed (Rs. 1,500 + R. 2,800 + Rs. 4,000) = Rs. 8,300

@ (100×5 + 50 × 6 + 100 × 7 + 100 × 8 = 2,300)

	<i>Under FIFO</i>	<i>Under LIFO</i>	<i>Difference</i>
(B) (a) Value of material consumed	Rs. 7,800	Rs. 8,300	Rs. 500
(b) Value of Closing stock	2,800	2,300	500

Reasons. (For materials consumed)

- On 6-4-88, 250 units were issued to production, Under FIFO, their value comes to Rs. 1,400 whereas under LIFO it works out to Rs. 1,500. Hence an amount of Rs. 100 was overcharged to production under LIFO.
- On 10-4-88, 400 units were issued to production and the value of material charged to production was Rs. 2,650 under FIFO whereas Rs. 2,800 was charged under LIFO. Hence Rs. 150 was overcharged to production under LIFO.
- On 14-4-88, 500 units were issued to production. Under FIFO, the value of material charged to production was Rs. 3,750 whereas Rs. 4,000 was charged under LIFO. Thus Rs. 250 was overcharged to production under LIFO.

To sum up, a total amount of Rs. 500 was over-charged to production.

Reasons (For Stock)

- Under FIFO, all the 350 units of closing stock belongs to the materials purchased on 12-4-88 whereas under LIFO these units were from opening balance and material purchased on 5-4-88, 8-4-88 and 12-4-88.
- Under FIFO 350 units of closing stock were valued at Rs. 8 per unit whereas under LIFO first 100 units. were valued at Rs. 5 per unit next 50 units at Rs. 6 per unit; next 100 units at Rs. 7 per unit and last 100 units at Rs. 8 per unit. Thus under FIFO, the value of closing stock increased by Rs. 500.

CA Final May, 1989

Problem 72. (Variance Analysis—Factors Contributed for change in Profit) The summarised results of a company for the two years ended 31st December 1988 and 1987 are given below:—

	1988 Rs. lacs	1987 Rs. lacs
Sales	770	600
Direct Materials	324	300
Direct wages	137	120
Variable Overhead	69	60
Fixed Overheads	150	80
Profit	90	40

As a result of re-organisation of production methods and extensive advertisement campaign used, the company was able to secure an increase in the selling prices by 10% during the year 1988 as compared to the previous year.

In the year 1987, the company consumed 1,20,000 kgs. of raw materials and used 24,00,000 hours of direct labour. In the year 1988, the corresponding figures were 1,35,000 kgs. of raw materials and 26,00,000 hours of direct labour.

You are required to:—

use the information given for the year 1987 as the base year information to analyse the results of the year 1988 and to show in a form suitable to the management the amount each factor has contributed by way of price, usage and volume to the change in profit in 1988.

Solution :

Statement showing Contribution made by different factors towards the change in Profits

S. No.	Reasons	Rs. in lakhs
		Amount
1.	Profit due to increase in Sales Price	(+) 70.0
2.	Profit due to Sales Volume	(+) 20.0
3.	Profit due to reduction in price of material	(+) 13.5
4.	Profit due to lower usage in material	(+) 12.5
5.	Reduction in Profit due to wage rate	(-) 7.0
6.	Profit due to efficient use of labour force	(+) 10.0
7.	Reduction in profit due to change in V.O.H. rate	(-) 4.0
8.	Profit due to efficient use of services leading to Variable OH	(+) 5.0
9.	Reduction in profit due to fixed OH. Exp. Variance	(-) 70.0
	Total Increase in profit	(+) 50.00 ⊕

⊕ This explains why profit has increased from 40 lakhs to 90 lakhs i.e. by 50 lakhs.

Working Notes

(1) Impact of Sales Value Variance

(SV ₁)—Sales in 1988	770 lakhs
(SV ₂)—Sales in 1988 at Sales price level of 1987 i.e. $(770,00,000 + 110) \times 100$	700 lakhs
(SV ₄)—Sales in 1987	600 lakhs

Note : Increase in Sales is $\frac{1}{6}$ th of 1987

Sales Value Price Variance $SV_1 - SV_2$ 70 lakhs (F)

Sales Value Volume Variance = $SV_2 - SV_4$ 100 lakhs (F)

Sales Price Variance fully contributes to change in profit

Impact of only Sales Value Volume Variance on profit is given below:

Rs. in lakhs			
	Sales level		Difference
	700	600	100 (F)
Sales			
Less Marginal Cost:			
Material	350	300	50 (A)
Labour	140	120	20 (A)
O.H.	70	60	10 (A)
	560	480	80 (A)
Contribution	140	120	20 (F)
Less Fixed Cost	80	80	—
Profit	60	40	20(F)⊕

This is the impact of Sales Value Volume Variance on profit. The readers should note particularly that Sales Value Volume variance does not fully contribute to change in profit like Sales Value Price Variance.

(2) Impact of Material Cost Variances :

(M₁) — Material Cost in 1988 i.e. Rs. 324 lakhs.
i.e. 1,35,000 kg × Rs. 240

(M₂) — Material Cost in 1988 at Price level of 1987
1,35,000 × Rs 250⊕ Rs. 337.50 lakhs.

⊕ Rs. 300,00,000 ÷ 1,20,000 kg = Rs. 250 per kg.

(M₄) — Material cost for 1988 level of output at Material Price of 1987
Material Cost in 1987 = Rs. 300 lakhs
Add 1/6th increase in volume in 1988 50 lakhs
Rs. 350 lakhs

Material Price Variance = $M_1 - M_2$
= Rs. 324 lakhs – Rs. 337.50 lakhs = Rs. 13.5 lakhs (F)

Material Usage Variance = $M_2 - M_4$
= Rs. 337.5 lakhs – Rs. 350 lakhs = Rs. 12.50 lakh (F)

(3) Impact of Labour Cost Variances.

L₁— Labour Cost in 1988 Rs. 137lakhs
i.e. 26,00,000 × Rs. 5.2692

L₂— Labour Cost in 1988 at Wage Rate level of 1987 Rs. 130 lakhs

26,00,000 hrs × Rs. 5⊕

⊕ Rs. 120,00,000 ÷ 24,00,000 kg = Rs. 5 per kg.

L₅– Labour Cost for 1988 level of Output at 1987 wage rate

Labour Cost in 1987 Rs. 120 lakhs

Add 1/6th due to increase in volume. Rs. 20 lakhs Rs. 140 lakhs.

Wage Rate Variance = $L_1 - L_2$ = Rs. 137 lakhs – Rs. 130 lakhs = 7 lakhs (A)

Wage Efficiency Variance = $L_2 - L_5$

= Rs. 130 lakhs – Rs. 140 lakhs = 10 lakhs (F)

(4) Impact of Variable Overhead Variance

VO₁ – V.O.H in 1988 Rs. 69 lakhs,

i.e. 26,00,000 hrs × Rs. 2.6538

VO₂ – V.O.H in 1988 at V.O.H rate level of 1987 Rs. 65 lakhs

26,00,000 × Rs. 2.5

⊕ Rs. 60,00,000 ÷ 24,00,000 hrs = Rs. 2.5 per hour

VO₃ – VOH for 1988 level of output at 1987 V.O.H. rate

V.O.H. in 1987 Rs. 60 lakhs

Add 1/6th due to increase in Volume 10 lakhs Rs. 70 lakhs

V.O.H. Expenditure Variance = $VO_1 - VO_2$

= Rs. 69 lakhs – Rs. 65 lakhs = Rs. 4 lakhs (A)

V.O.H. Efficiency Variance = $VO_2 - VO_3$

= Rs. 65 lakhs – Rs. 70 lakhs = Rs. 5 lakhs (F)

(5) Impact of Fixed O.H. Variance

FO₁ – FOH in 1988 Rs. 150 lakhs

FO₂ – Budgeted FO Rs. 80 lakhs

Fixed O.H. Expenditure Variance = $FO_1 - FO_2$

= Rs. 150 lakhs – Rs. 80 lakhs = Rs. 70 lakhs (A)

Problem 73. (Determining existing & planned profitability using CVP Analysis) SV Ltd, engaged in the manufacture of four products has prepared the following budget for 1989 :

	<i>Products</i>			
	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>
Production Units	20,000	5,000	25,000	15,000
Selling Price Rs./Unit	21.75	36.75	44.25	64.00
Direct Materials Rs./Unit	6.00	13.50	10.50	24.00
Direct Wages Rs./Unit	7.50	10.00	18.00	24.00
Variable Overheads Rs./Unit	2.25	5.00	6.00	6.50
Fixed Overheads Rs. per annum	75,000	25,000	2,25,000	1,80,000

When the budget was discussed, it was proposed that the production should be increased by 10,000 Units for which capacity existed in 1989.

It was also decided that for the next year i.e. 1990, the production capacity should be further increased by 25,000 units over and above the increase of 10,000 units envisaged as above for 1989. The additional production capacity of

25,000 units should be used for the manufacture of Product 'B' for which new production facilities were to be created at an annual fixed overhead cost of Rs. 35,000. The direct material costs of all the four products were expected to increase by 10% in 1990 while the other costs and selling prices would remain the same.

Required:—

- Find the profit of 1989 on the assumption that the existing capacity of 10,000 units is utilised to maximise the profit.
- Prepare a statement of profit for 1990.
- Assuming that the increase in the output of Product 'B' may not fully materialise in the year 1990, find the number of units of Product B to be sold in 1990 to earn the same overall profit as in 1989.

Solution: Before finding out the profit for 1989, it is necessary to work-out the contribution per unit for various products:

	<i>Per Unit</i>			
	<i>Products</i>			
	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>
1. Selling Price	Rs. 21.75	Rs. 36.75	Rs. 44.25	Rs. 64.00
2. Less Variable Costs:				
Direct Materials	6.00	13.50	10.50	24.00
Direct Wages	7.50	10.00	18.00	24.00
Variable Overhead	<u>2.25</u>	<u>5.00</u>	<u>6.00</u>	<u>6.50</u>
	<u>15.75</u>	<u>28.50</u>	<u>34.50</u>	<u>54.50</u>
3. Contribution (1 – 2)	6.00	8.25	9.75	9.50
4. Ranking	IV	III	I	II

Existing Production 20,000 + 5,000 + 25,000 + 15,000 = 65,000 units
 Existing spare Capacity of 10,000 units has to be utilized by increasing production of C to 35,000 units.

	<i>Products</i>				
	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>Total</i>
1. Revised Production (Units)	20,000	5,000	35,000	15,000	75,000
2. Contribution per unit	Rs. 6.00	Rs. 8.25	Rs. 9.75	Rs. 9.50	
3. Total contribution	120,000	41,250	3,41,250	1,42,500	6,45,000
4. Fixed Overheads	<u>75,000</u>	<u>25,000</u>	<u>2,25,000</u>	<u>1,80,000</u>	<u>5,05,000</u>
5. Profit (3–4)	<u>45,000</u>	<u>16,250</u>	<u>1,16,250</u>	<u>(37,500)</u>	<u>1,40,000</u>

(b) Statement showing the profitability of the products during 1990

	Products				(per unit)
	A	B	C	D	Total
1. Production	20,000	30,000	35,000	15,000	1,00,000
2. Contribution	Rs. 6.00	Rs. 8.25	Rs. 9.75	Rs. 9.50	
3. Less 10% increase in DM cost	<u>0.60</u>	<u>1.35</u>	<u>1.05</u>	<u>2.40</u>	
4. Revised contribution	<u>5.40</u>	<u>6.90</u>	<u>8.70</u>	<u>7.10</u>	
5. Total Contribution (1 × 4)	1,08,000	2,07,000	3,04,500	1,06,500	7,26,000
6. Fixed overheads	<u>75,000</u>	<u>60,000</u>	<u>2,25,000</u>	<u>1,80,000</u>	<u>5,40,000</u>
7. Profit (5-6)	<u>33,000</u>	<u>1,47,000</u>	<u>79,500</u>	<u>(73,500)</u>	<u>1,86,000</u>

(c) Desired Contribution = Fixed Cost Rs. 5,40,000
 + Desired Profit 1,40,000

6,80,000

Less Contribution from products A, C & D 5,19,000

Contribution desired from product B 1,61,000

Number of Units of product B to be

Sold = Rs. 1,61,000 ÷ Rs. 6.90@ = 23,333 units

@ Contribution per unit from product B.

Problem 74. (EOQ and savings from new ordering system) A firm is engaged in the manufacture of two products 'A' and 'B'. Product A uses one unit of component 'P' and two units of component 'Q'. Product B uses two units of component 'P', one unit of component 'Q' and two units of component 'R'. Component 'R' which is assembled in the factory uses one unit of component 'Q'. Components 'P' and 'Q' are purchased from the market.

The firm has prepared the following forecast of sales and inventory for the next year.

		Products	
		A	B
Sales	Units	8,000	15,000
Inventories :			
At the end of the year	Units	1,000	2,000
At the beginning of the year	Units	3,000	5,000

The production of both the products and the assembling of the component 'R' will be spread out uniformly throughout the year.

The firm at present orders its inventory of components 'P' and 'Q' in quantities equivalent to 3 months' consumption. The firm has been advised that savings in the provisioning of components can arise by changing over to the ordering system based on economic ordering quantities. The firm has compiled the following data relating to two Components.

		P	Q
Component usage per annum		30,000	48,000
Price per unit	Rs.	2.00	0.80
Order placing costs per order	Rs.	15.00	15.00
Carrying costs p.a.	%	20	20

Required :—

(a) Prepare a budget of production and requirements of components for the next year.

(b) Find the economic order quantity.

(c) Based on the economic order quantity calculated in (b) above, calculate the savings arising from switching over to the new ordering system both in terms of cost and reduction in working capital.

(a) *Statement showing production budget of Products A & B.*

Solution :

(In units)

	<u>Products</u>	
	A	B
Closing inventory	1,000	2,000
Add Sales	<u>8,000</u>	<u>15,000</u>
	9,000	17,000
Less Opening inventory	<u>3,000</u>	<u>5,000</u>
Production	<u>6,000</u>	<u>12,000</u>

Budget requirements of components P, Q & R

	P	Q	R
<i>For A</i> 1 unit of P × 6000	6000		
2 units of Q × 6000		12000	
<i>For B</i> 2 units of P × 12,000	24,000		
1 unit of Q × 12,000		12,000	
2 units of R × 12,000			24,000
<i>For R</i> 1 unit of Q × 24,000		<u>24,000</u>	
	<u>30,000</u>	<u>48,000</u>	<u>24,000</u>

$$(b) EOQ = \sqrt{\frac{2 \times \text{Annual consumption} \times \text{Buying cost per order}}{\text{Cost per unit} \times \text{storage and carrying cost rate}}}$$

<i>Component P</i>	<i>Component Q</i>
$\sqrt{\frac{2 \times 30,000 \times 15}{2 \times 20\%}}$	$\sqrt{\frac{2 \times 48,000 \times 15}{0.80 \times 20\%}}$
= 1500 units	= 3000 units

(c) Existing System

1. Present order quantity

(Equivalent to 3 months consumption)

<u>Component P</u>	<u>Component Q</u>
$30,000 \times 1/4$	$48,000 \times 1/4$
= 7500 units	12000 units
3750 "	6,000 "
Rs. 7500	Rs. 4800

2. Average stock (Col 1 + 2)

3. Investment in inventory

(Col 2 × Rs. 2 for P/Re 0.80 for Q)

4. Total investment

5. Carry cost (20% of 12,300)

Rs. 12,300

Rs. 2,460

6. Ordering Cost = No. of orders \times ordering cost

$$\text{per order } P = 4^* \times \text{Rs. } 15 = 60$$

$$Q = 4^* \times 15 = 60$$

Total cost (5 + 6)

$$\frac{120}{2580}$$

* No of orders $\frac{P}{30,000 + 7,500} = 4$ $\frac{Q}{48,000 + 12,000} = 4$
After Switching over to the new ordering System

	$\frac{P}{1,500}$ units	$\frac{Q}{3,000}$ units
1. EOQ	1,500	3,000
2. Average stock	750	1,500
3. Investment in inventory		
Col 2 \times Rs. 2 for P	Rs. 1,500	Rs. 1,200
\times Re 0.80 for Q		
4. Total investment		Rs. 2,700
5. Carrying Cost 20% of Rs. 2,700		540
6. Ordering Cost		

$$P \ 20^@ \times \text{Rs. } 15 = \text{Rs. } 300$$

$$Q \ 16^@ \times \text{Rs. } 15 = 240$$

Total cost (5 + 6)

$$\frac{540}{1,080}$$

Savings in costs Rs. 2580 – Rs. 1,080 = Rs. 1500

Reduction in working capital = Rs. 12,300 – Rs. 2,700 = Rs. 9600

$\frac{P}{30,000 + 1,500} = 20$ $\frac{Q}{48,000 + 3,000} = 16$

Problem 75. (Selling as it is vs. Further Processing) A company is able to obtain 2,00,000 kgs. of A and 4,00,000 kgs. of B from the input of 6,00,000 kgs. of a raw material 'F'. The selling prices of these outputs are A = Rs. 6 per kg. B = Rs. 4.50 per kg. The processing costs are

Raw Materials 6,00,000 \times 2	Rs. 12,00,000
Variable processing costs	6,00,000
Fixed processing costs	2,00,000
Total	20,00,000

The company has three proposals for consideration :—

- Product A can be further processed by mixing it with other purchased materials. The entire quantity of the resultant product 'P' can be sold at Rs. 13 per kg. Each kg. of 'P' requires one kg. of A and the processing costs amount to Rs. 16,00,000.
- There is an offer to purchase an additional quantity of 40,000 kgs. of Product 'B' at a price of Rs. 3.50 per kg. The existing market for 'B' will not be affected by this proposal. All the production of Product A can be sold at a uniform price.
- A new raw material has just become available. The processing costs will remain the same but the process will now yield 2 kgs. of A for

every 3 kgs. of Product B. The total quantity of the new raw material available is limited to 6,00,000 kgs.

Required :—

- (i) Find the original profit on sale of A and B
- (ii) Evaluate the proposal for further processing of 'A' into 'P'
- (iii) In the case of proposal (b), the increased quantum of 'A' will reduce its selling price. Find the minimum average price of 'A' that will sustain the increased quantum of sales.
- (iv) Evaluate proposal (c) and find the maximum price the company can afford to pay for the new raw material by retaining the existing profit.

Solution (i) *Statement showing original profit on sale of A and B*

	<u>Products</u>		
	A	B	Total
Sales volume (kgs.)	2,00,000	4,00,000	6,00,000
Selling price per kg.	Rs. 6	Rs. 4.50	
Sales Value	Rs. 12,00,000	Rs. 18,00,000	Rs. 30,00,000
Sales Value Ratio	2	: 3	
<i>Variable Costs</i>			
Raw Materials (2 : 3)	4,80,000	7,20,000	12,00,000
Processing Costs (2 : 3)	<u>2,40,000</u>	<u>3,60,000</u>	<u>6,00,000</u>
Total	<u>7,20,000</u>	<u>10,80,000</u>	<u>18,00,000</u>
Contribution	4,80,000	7,20,000	12,00,000
Fixed Cost (2 : 3)	<u>80,000</u>	<u>1,20,000</u>	<u>2,00,000</u>
Profit	<u>4,00,000</u>	<u>6,00,000</u>	<u>10,00,000</u>

(ii) *Evaluation of proposal of further processing of A into P*

Alternative (a) Contribution if product A is not further processed into P Rs. 4,80,000

Alternative (b) Contribution if product A is further processed into P

Variable cost of A Rs. 7,20,000

Further processing cost 16,00,000

Total Cost 23,20,000

Sales of P 26,00,000

Contribution from alternative (b) 2,80,000

Reduction in contribution due to further processing 2,00,000

Recommendation : Further processing of A into P is not advisable as it will lead to a loss of Re 1 per unit or Rs. 2,00,000.

(iii) (a) Present Variable Cost of A

for producing 2,00,000 kg = Rs. 7,20,000

(b) Present Fixed Cost of A = 80,000

(c) Present Profit = 4,00,000

(d) Additional Cost of producing 20,000

kgs. of A to facilitate producing

3,40,000 kg. of B (10% of (a) above) = 72,000

Total to be recovered from sale of 2,20,000 units of A

12,72,000

∴ Reduced selling price of A = Rs. 5.78 per kg.

(Rs. 12,72,000 + 2,20,000)

Note : (i) In brief, the present total cost of A present profit plus the additional cost of producing A (only as much units of A as are required to facilitate producing 40,000 units of B) is to be borne by 2,20,000 units.

- (ii) (a) Total Variable Cost (existing) = Rs. 6,00,000
 (b) Fixed Cost " = 2,00,000
 (c) Existing profit = 10,00,000
 (d) Existing total cost excluding material plus profit = 18,00,000
 (e) Total realisation as per (c).
 A – 2,40,000 kg × Rs. 6 = Rs. 14,40,000
 B – 3,60,000 kg × Rs. 4.50 = 16,20,000 30,60,000
 (f) Excess of (e) Over (d) i.e. Rs. 12,60,000 is the maximum price (balance left now) that can be paid for new raw material.
 ∴ New raw material price per kg = Rs. 12,60,000 ÷ 60,000 = Rs. 2.10 per kg.

I.C.W.A. Inter, June 1989

Problem 76. (Computation of bonus and total wages cost) In an engineering concern, the employees are paid incentive bonus in addition to their normal wages at hourly rates. Incentive bonus is calculated in proportion of time taken to time allowed, of the time saved. The following details are made available in respect of employees X, Y and Z for a particular week :

	X	Y	Z
Normal Wages (Rs. per hour)	4.00	5.00	6.00
Completed Unit of production	6000	3000	4800
Time Allowed (per 100 units)	0.8 hrs.	1.5 hrs.	1 hr.
Actual time taken (hours)	42	40	48

You are required to work out for each employee :

- (i) the amount of bonus earned;
 (ii) the total amount of wages received ;
 (iii) the total wages cost per 100 units of output.

Solution (a) *Statement showing the amount of bonus earned, total amount of wages and total wages cost per 100 units*

	X	Y	Z
Production (Units)	6,000	3,000	4,800
Time allowed for 100 units (hr.)	0.8	1.5	1.0
Time allowed for production (hr.)	48	45	48
Actual time taken	42	40	48
Time saved	6	5	—
Normal wage rate (Rs/hr)	4	5	6
(i) Bonus earned	Rs. 21*	22.22	—
Basic wages (Time taken × basic wage rate)	168	200	288
(ii) Total wages cost	189	222.22	288
(iii) Wages cost per 100 units	3.15	7.41	6.00

$$\begin{aligned}
 & * \frac{\text{Time taken}}{\text{Time allowed}} \times \text{Time saved} \times \text{Wage rate} \\
 & = \frac{42}{48} \times 6 \times \text{Rs. } 4 = \text{Rs. } 21
 \end{aligned}$$

Other values calculated similarly.

Problem 77. (Allocation of Advertising Cost) A company is producing three types of products A, B, C. The sales territory of the company is divided into three areas X, Y & Z.

The estimated sales and the advertising cost for the next year are as under:—

Sales

Products	Territories		
	X	Y	Z
	Rs.	Rs.	Rs.
A	25,000	10,000	—
B	15,000	—	40,000
C	—	35,000	20,000

Advertising Cost

	Territories			Total
	X	Y	Z	
	Rs.	Rs.	Rs.	Rs.
Local direct cost	3,200	4,500	4,200	11,900
Common cost	—	—	—	5,800
				<u>17,700</u>

You are required to prepare a statement showing *territory-wise* advertising cost expressed as a *percentage of sales*. The allocation of advertising cost should be based on sales as given above.

Solution. Territory-Wise Advertising Cost

	Territories			Total
	X	Y	Z	
Sales (Rs.)	40,000 [⊕]	45,000	60,000	1,45,000
%	27.59	31.03	41.38	100%
Advertising cost				
Local direct cost	Rs. 3,200	Rs. 4,500	Rs. 4,200	Rs. 11,900
Prorated common cost	<u>1,600</u>	<u>1,800</u>	<u>2,400</u>	<u>5,800</u>
Total advertising cost	<u>4,800</u>	<u>6,300</u>	<u>6,600</u>	<u>17,700</u>
Total advertising cost expressed as % of Sales	12%	14%	11%	12.21%

⊕ For all product

Problem 78 (Estimating selling prices when monthly capacity utilisation is given) A manufacturing company has an installed capacity of 1,20,000 units per annum. The cost structure of the products manufacturer is as under :

- (i) Variable cost (per unit)
 Material Rs. 8-00
 Labour Rs. 8-00
 (subject to a minimum of Rs. 56,000 per month)
 Overheads Rs. 3-00
- (ii) Fixed overheads Rs. 1,04,000 per annum
- (iii) Semi-variable overheads Rs. 48,000 per annum at 60% capacity, which increase by Rs. 6,000 per annum for increase of every 10% of the capacity utilisation or any part thereof.

The capacity utilisation for the next year is estimated at 60% for 2 months, 75% for 6 months and 80% for the balance part of the year. If the company is planning to have a profit of 25% on the selling price, calculate the *estimated selling price for each unit of production*. Assume there is no opening or closing stock.

Solution : Installed Capacity per annum (units)	=	1,20,000
Production per month at 100% capacity (units)	=	10,000
60% for 2 months = 6,000 units × 2	=	12,000 units
75% for 6 months = 7,500 " × 6	=	45,000 "
80% for 4 months = 8,000 " × 4	=	<u>32,000</u> "
Total production for the year		<u>89,000</u> "

It should be noted that *only one price has to be worked out and not different prices at different capacity levels*.

Variable cost per unit is given. However, there is a minimum labour cost per month irrespective of capacity utilization. Therefore, total labour cost has to be found out :

For 2 months = Rs. [⊕] 56,000 × 2 months	=	Rs. 1,12,000
For 6 months = 45,000 × Rs. 8	=	3,60,000
For 4 months = 32,000 × Rs. 8	=	<u>2,56,000</u>
Total labour cost	=	Rs. <u>7,28,000</u>

⊕ Minimum Rs. 56,000 per month and *not* 6000 × Rs. 8
 = 48,000 p.m. or Rs. 96,000 for two months

Semi-Variable Cost

Semi Variable Cost 48,000 p.a. at 60% Capacity or Rs. 4,000 p.m.

60% Capacity for 2 months	Rs. 8,000
75% Capacity for 6 months (15% increase in capacity rounded off to 20% increase)	
Rs. 4,000 p.m. + Rs. 1000 p.m. = Rs. 5,000 × 6	= 30,000
80% capacity for 4 months 5000 × 4	= <u>20,000</u>
	<u>58,000</u>

Estimated Selling price per unit

Total production	<u>89,000</u> units
Materials 89,000 × Rs. 8-00	= Rs. 7,12,000
Labour (as worked out above)	7,28,000
Variable Overheads 89,000 × Rs. 3	2,67,000

Semi-Variable overheads (as above)	58,000
Fixed Overheads	<u>1,04,000</u>
Total Cost	18,69,000
Profit 25% on sales or one-third of cost	<u>6,23,000</u>
Total sales	<u>24,92,000</u>
Selling price per unit	<u>Rs. 28</u>

Problem 79. (Material and Labour Cost Variances) The following details relating to the product 'X' during the month of March 1989 are available. You are required to compute the material and labour cost variances and also to reconcile the standard and the actual cost with the help of such variances.

Standard Cost per unit—

Materials 50 kg. @ Rs. 40 per kg.
Labour 400 hours @ Rs. 1.00 per hour

Actual Cost for the month—

Material 4900 kgs. @ Rs. 42 per kg.
Labour 39600 hours @ Rs. 1.10 per hour

Actual production—100 units.

Solution :

For Material Cost Variances.

M₁— Actual Cost of material used— 4900 kg × Rs. 42 = Rs. 2,05,800

M₂— Standard Cost of material used 4900 kg × Rs. 40 = Rs. 1,96,000

M₃— Nil

M₄— Standard Material Cost of Production

100 units × (50 kg × Rs. 40) = Rs. 2,00,000

Material Price Variance = M₁ – M₂ = Rs. 2,05,800 – 1,96,000 = Rs. 9,800 (A)

Material Usage or Volume Variance = M₂ – M₄

= Rs. 1,96,000 – Rs. 2,00,000 = Rs. 4,000 (F)

For Labour Cost Variances

L₁— Actual Payment made to worker for actual hours worked

39,600 hrs. × Rs. 1.10 = Rs. 43,560

L₂— Actual payment if the workers had been paid at standard rate

39,600 hrs × 1.00 = Rs. 39,600

L₃ & L₄—Nil

L₅— Standard labour cost of production

100 units × (400 × Rs. 1.00) = Rs. 40,000

Wage rate variance = L₁ – L₂ = Rs. 43,560 – 39,600 = 3,960 (A)

Wage Efficiency Variance = L₂ – L₅ = Rs. 39,600 – Rs. 40,000 = Rs. 400 (F)

Statement showing the Reconciliation

Actual Cost of production:

Material 4,900 kg × Rs. 42	=	2,05,800
Labour 39,600 hrs × Rs. 1-10	=	<u>43,560</u>
		2,49,360

Less: Adverse Cost Variance :

Material Price Variance Rs. 9,800		
Wage Rate Variance <u>3,960</u>		<u>13,760</u>
		2,35,600

Add : Favourable Cost Variances

Material Usage Variance Rs. 4,000		
Wage Efficiency Variance <u>400</u>		<u>4,400</u>

Standard Cost of production

2,40,000 ⊕

⊕ Check.

Standard Cost

Material 100 × 50 kg × Rs. 40	=	Rs. 2,00,000
Labour 100 × 400 hrs × Rs. 1	=	<u>40,000</u>
		<u>2,40,000</u>

For question on Equivalent Production, please refer to Problem 6-17 at page P 6-31

Problem 80. (Apportionment of Joint Costs—Working Back Method) In manufacturing the main product A, a Company processes, the resulting waste material into two by-products M₁ and M₂. Using the method of working back from sales value to an estimated cost, you are required to prepare a comparative profit and loss statement of the three products from the following data :

(i) Total Cost upto separation point was Rs. 1,36,000

	A	M ₁	M ₂
(ii) Sale (all production)	Rs. 3,28,000	Rs. 32,000	Rs. 48,000
(iii) Cost after separation	Rs. —	9,600	14,400
(iv) Estimated net profit percentage to sale value	—	20%	30%
(v) Estimated selling expenses as percentage of sale value	20%	20%	20%

Solution : *Statement showing the apportionment of joint costs at the point of separation*

Total cost up to point of separation

Rs. 1,36,000

Less: Cost of By-products by working backward				
	M₁	M₂		
Sales realisation			Rs. 32,000	Rs. 48,000
	M₁	M₂		
Less : Net profit				
(20% and 30% of Sales)	6,400	14,400		
Selling expenses (20% of sale)	6,400	9,600		
Cost after separation	9,600	14,400		
			<u>22,400</u>	<u>38,400</u>
			9,600	9,600
Cost to be apportioned after split-off point				<u>1,16,800</u>

Comparative Profit & Loss Account

Details	A	M ₁	M ₂	Total
1. Sales (Rs.)	3,28,000	32,000	48,000	4,08,000
2. Cost of Sales				
Pre-Separation cost	1,16,800	9,600	9,600	1,36,000
Post-Separation cost	—	<u>9,600</u>	<u>14,400</u>	<u>24,000</u>
Cost of production	1,16,800	19,200	24,000	1,60,000
Selling expenses	<u>65,600</u>	<u>6,400</u>	<u>9,600</u>	<u>81,600</u>
Cost of Sales	<u>1,82,400</u>	<u>25,600</u>	<u>33,600</u>	<u>2,41,600</u>
3. Profit (1 - 2)	<u>1,45,600</u>	<u>6,400</u>	<u>14,400</u>	<u>1,66,400</u>
4. Profit as a % of sales	44.4%	20%	30%	40.8%

Problem 81. (Computation of Material Cost Variances when price Variances are calculated at the time of purchase) From the data given below, calculate :

- Individual material price variances for the two materials X and Y assuming that price variances are calculated at the time of purchase;
- Individual material usage variances for materials 'X' and 'Y', assuming that there was no work-in-progress either at the commencement or at the end of the period.

	X		Y	
	Qty	Value	Qty	Value
Raw material purchases	2,000 kg.	Rs. 4,000	5,000 kg.	Rs. 6,250
Issues to works	2,150 kg.	—	3,950 kg.	—
Works stock of material:—				
Opening	300 kg.	—	1,000 kg.	—
Closing	200 kg.	—	1,250 kg.	—

Standard price— Material X—Rs. 1.90 per kg.

Material Y—Rs. 1.30 per kg.

Standard usage—

	Material X	Material Y
Product A	1 kg.	1 kg.
Product B	0.5 kg.	1 kg.

Output during the period—

Product A —1,130 units

Product B — 2,550 units.

Solution :**For Material Cost Variances**

	'X'	'Y'
M ₁ — Actual Cost of material used	Rs. 4,000	Rs. 6,250
M ₂ — Standard cost of material used		
2000 kg [⊕] × Rs. 1.90	3,800	
5000 kg × Rs. 1.30		6,500

[⊕] Since material price variance is calculated at the time of purchase

M₂— For finding out the value of material usage variance,
the value of M₂ will be based on actual usage

	X	Y
Opening stock	300 kg	1000 Kg
Issued to works	<u>2,150 kg</u>	<u>3,950 kg</u>
	2,450 kg	4,950 kg
Less closing stock	<u>200 kg</u>	<u>1,250 kg</u>
	2,250 kg	3,700 kg
∴ Standard Cost of Material Consumed	X	Y
2250 × 1.90	Rs. 4,275	
3,700 × 1.30		Rs. 4,810
M ₃ —Not Applicable		
M ₄ —Standard Material Cost of production Rs.		
Mat. X → Product A 1130 × 1 kg × 1.90 = 2147.00		
Product B 2550 × 0.50 × 1.90 = <u>2422.50</u>	4569.5	
Mat. Y → Product A 1130 × 1.30 = 1469.00		
Product B 2550 × 1 × 1.30 = <u>3315.00</u>		4784

Material Price Variance—M₁ – M₂

Material X : Rs. 4000 – Rs. 3800 = Rs. 200 (A)

Material Y : Rs. 6250 – Rs. 6500 = Rs. 250 (F)

Material Usage Variance M₂ (actual usage)– M₄

Material X : Rs. 4275 – 4569.5 = Rs. 294.50 (F)

Material Y : Rs. 4810 – 4784 = Rs. 26.00 (A)

Note :— A separate Value of M₂ will have to be computed based on material consumed

Problem 82. (Number of motors sold to BE with change in price)

The Asian Industries specialise in the manufacture of small capacity motors.

The cost structure of a motor is as under:—

Material	Rs. 50
Labour	Rs. 80
Variable Overheads	75% of labour cost

Fixed overheads of the Company amount to Rs. 2-40 lakhs per annum. The sale price of the motor is Rs. 230 each.

- Determine the number of motors that have to be manufactured and sold in a year in order to break-even.
- How many motors have to be made and sold to make a profit of Rs. one lakh per year?
- If the sale price is reduced by Rs. 15 each, how many motors have to be sold to break-even?

Solution (a) Sale price Rs. 230

Less : Variable cost

Material	Rs. 50	
Labour	80	
Variable Overhead	<u>60</u>	<u>190</u>
Contribution		<u>40</u>

B.E. Sales \times P/V Ratio = Fixed Cost

B.E. Sales \times (230 - 190)/230 = Rs. 2,40,000

B.E. Sales = Rs. 13,80,000 or 6,000 motors

(b) Contribution = Rs. 3,40,000 (Profit Rs. 1,00,000 + Fixed cost Rs. 2,40,000)

If contribution is Rs. 40 number of motors = 1

If contribution is Rs. 3,40,000 number of motors = $3,40,000 \div 40$

= 8,500 motors

(c) Reduced selling price Rs. 215

Less Variable Cost 190

Revised contribution 25

B.E. Sales = $2,40,000 \div 25 = 9600$ motors.

Problem 83. (Determining profitability with multiple limiting factors) (a) The following particulars are extracted from the records of a company :—

	<i>Product A</i>	<i>Product B</i>
	<i>Per unit</i>	<i>Per unit</i>
Sales	Rs. 100	Rs. 120
Consumption of material	2 kg.	3 kg.
Material Cost	Rs. 10	Rs. 15
Direct wages cost	Rs. 15	Rs. 10
Direct expenses	Rs. 5	Rs. 6
Machine Hours used	3	2
Overhead expenses :		
Fixed	Rs. 5	Rs. 10
Variable	Rs. 15	Rs. 20

Direct wages per hour is Rs. 5. Comment on profitability of each product (both use the same raw material) when

- Total sales potential is limited;

- (ii) Raw Material is in short supply;
 (iii) Production capacity (in terms of machine hours) is the limiting factor.
 (b) Assuming Raw Material as the key factor, availability of which is 10,000 kg. and maximum sales potential of each product being 3,500 units, find out the product mix which will yield the maximum profit.

• **Solution (a)**

	<i>Product A</i> Rs. 100	<i>Product B</i> Rs. 120
1. Selling price per unit		
2. Variable Cost:		
Material	10	15
Direct Wages	15	10
Direct expenses	5	6
Variable Overheads	<u>15</u>	<u>20</u>
	<u>45</u>	<u>51</u>
3. Contribution (1 - 2)	55	69
4. P/V Ratio	55% 57.5%	
Ranking when sales is limiting factor	II	I
Raw material requirement	2 kg.	3 kg.
Contribution per kg.	Rs. 27.5	Rs. 23
Ranking when raw material in short supply	I	II
Machine hours	3 hours	2 hours
Contribution per machine hour	Rs. 18.33	Rs. 34.5
Ranking when production capacity is Limiting factor	II	I
(b) Total raw material	=	10,000 kg.
Less raw material used for producing 3,500 units of Product A (3,500×2)	=	<u>7,000</u>
Balance material to be used for Product B		3,000
Number of units of Product B produced	=	3000 ÷ 3 = 1000 units
Product Mix = A : B = 3500 : 1000		

	Total	Product A	Product B
Contribution per unit		Rs. 55	Rs. 69
Total contribution	261,500	1,92,500	69,000
Less : Fixed Cost	<u>27,500</u>	<u>17,500</u>	<u>10,000</u>
Profit	<u>2,34,000</u>	<u>1,75,000</u>	<u>59,000</u>

I.C.W.A. Final, June 1989

For question on manufacture of bottles and plastic moulded toys vs. Sub-contracting please refer to Problem 10-47 on page P 10-105.

For problem on imbalanced Capacity—Installation of a new plant please refer to Problem 10-27 on Page P 10-54 .

For question on budgetary control, please refer to problem 11-31 on page P 11-79 (Figures reduced to one-fourth)

For question on accepting or rejecting an offer, please refer to Problem 10-58 on page P 10-137.

For question on pricing and purchasing option, please refer to Problem 15-20 on Page P 15-31.

For question on curvilinear CVP Analysis, please refer to Problem 9-7.

Problem 84. (Profitability of converting single purpose machine to all purpose machine) A company produces four products A, B, C and D which are marketed in cartons. Of the total of 20 machines installed, 8 are suitable for manufacturing all the four products and the remaining 12 machines are not suitable for the manufacture of products A and D.

Each machine is in production for 300 days per year and each is used on a given product in terms of full days and not in fractions of days. The company however has no problem in obtaining adequate supplies of labour and raw materials.

The marketing policy is that all four products should be sold and the minimum annual production should be 3000 cartons for each product. Fixed costs budgeted amount to Rs. 50 lacs. Production cost and price data are as under:—

		A	B	C	D
Production/day/machine (Cartons)		14	4	3	6
Selling Price/Carton	Rs.	810	790	845	1290
Cost: Process I					
Direct Material/day/Machine	Rs.	140	52	45	84
Direct Labour/day/Machine	Rs.	224	148	90	132
Process II					
Direct Material/Carton	Rs.	30	30	30	30
Direct Labour/Carton	Rs.	240	216	300	360
Variable Overheads/Carton	Rs.	390	390	300	720

With a view to meeting the increasing demand for products A and D, the company is contemplating to convert such number of machines as may be necessary out of the 12 machines which at present are unsuitable to produce products A and D into all purpose machines. The cost of conversion of these machines is Rs. 2,10,000 per machine. The expenditure is to be amortised over a period of three years. The company expects 12.5% return on this expenditure.

Market research indicates that the company's sales of Products A and D can be increased to 37,500 cartons and 5,400 cartons respectively.

Required :

- Calculate the optimum profit of the company if the existing machines were worked on most profitable basis before conversion.
- recommend the maximum number of machines to be converted into all purpose machines giving supporting calculations.
- calculate for the first year the optimum profit of the company after conversion of the required number of machines into all purpose machines.

Solution :

<i>Products</i>	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>
Cartons/day/machine	14	4	3	6
Minimum Sales	3,000	3,000	3,000	3,000
No of days for Minimum Sales	215	750	1,000	500
Profitability:				
Sales/Carton	Rs. 810	Rs. 790	Rs. 845	Rs. 1,290
Process 1, Direct Materials	Rs. 10	Rs. 13	Rs. 15	Rs. 14
Direct Wages	16	37	30	22
Process 2, Direct Materials	30	30	30	30
Direct Labour	240	216	300	360
Variable Overhead	390	390	300	720
	686	686	675	1,146
Contribution/Carton	124	104	170	144
Contribution/Machine day	1,736	416	510	864

(a) Optimum Profit before conversion :

All purpose machines are 8

 \therefore Machine hours available $300 \times 8 = 2,400$ days.

For Minimum of D 500 days.

Available for A 1900 days

No. of Cartons of A = $1900 \text{ days} \times 14 = 26,600$ unitsFor other machines, days available = $12 \times 300 = 3,600$ days

For Minimum of B = 750 days

Days available for production of B 2850 days

No. of Cartons to be produced = $2850 \times 3 = 8550$ cartons**Optimum Mix before Conversion :**

<i>Products</i>	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>
No. of cartons	26,600	3,000	8,550	3,000
Contribution/carton	124	104	170	144
Total Contribution	Rs. 32,98,400	3,12,000	14,53,500	4,32,000
Total Contribution of all products			Rs. 54,95,900	
Fixed Costs				50,00,000
Profit				4,95,900

(b) Maximum No. of Machines to be Converted :

After Conversion production of A can go upto 37,500 cartons and production of D can be increased upto 5,400 cartons.

	<i>A</i>	<i>D</i>
Additional Units		
(37,500 – 26,600)	10,900	
(5,400 – 3,000)		2,400
No of cartons per day	14	6
No of days required	779	400
Total No of days required		1,179
		or 1,200

Hence 4 machines should be converted.

(c) Optimum profit after conversion in first year

<i>Product Mix After Conversion (1)</i>	<i>No of days (2)</i>	<i>Machine Days required (1+2)</i>
A 37,500	14	2,679
B 3,000	4	750
C 5,013	3	1,671 *
D 5,400	6	900
Maximum hrs. available (20×300)		6,000

Profit on above Mix.

	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>
No of Cartons	37,500	3,000	5,013	5,400
Contribution per Carton	<u>Rs. 124</u>	<u>Rs. 104</u>	<u>Rs. 170</u>	<u>Rs. 144</u>
Total Contribution	<u>46,50,000</u>	<u>3,12,000</u>	<u>8,52,210</u>	<u>7,77,600</u>
Total Contribution for all products	=			Rs. 65,91,810
Less Fixed Cost				<u>50,00,000</u>
				15,91,810
Amortisation of Conversion Cost of 4 machines				*
in 3 years i.e. (2,10,000 × 4) + 3	=			<u>2,80,000</u>
				13,11,810
Earlier Profit before Conversion				<u>4,95,900</u>
Less : Minimum profit @ 12.5%				8,15,910
expected on Investment of Rs. 8,40,000				<u>1,05,000</u>
Extra margin still available				<u>7,10,910</u>

Problem 85. (Preparation of Budget after adjusting various factors) The following details have been extracted from the books of a company for the year ended 31st March, 1989.

	<i>Rs.</i>
Sales	13,60,800
Direct Materials	4,00,000
Direct Wages	2,80,000
Direct Expenses	20,000
Factory Overheads	1,40,000
Administration Overheads	1,68,000
Selling Overheads	1,26,000
Profit	2,26,800

50% of factory overheads and 60% of selling overheads are analysed as variable.

* Balance hours to be used for C because its contribution per day is better than B

The forecasts for the next year are as under (i.e. year ending 31.3.1990).

(i) Sales volume will increase by 30% but the selling price will be reduced by 5%.

(ii) The raw material prices will remain unchanged but because of increased purchases a quantity discount of 5% will be obtained.

(iii) Variable Overheads (Selling and Factory), Direct Wages and Expenses will increase in proportion to Sales Volume.

(iv) Wages and Factory Overheads (variable only) will further go up by 10% for increase in rates.

(v) Administration Overheads will decrease by 2%.

(vi) There will be no stocks of work-in-progress and finished goods in the beginning or end of the year.

Required :

(a) Prepare a budget for the next year i.e. year ending 31st March 1990.

(b) Establish rates of recovery of factory, administration and selling overheads.

(c) The Company is required to quote for an export order. The direct materials, direct wages and direct expenses relating to this order are Rs. 50,000, Rs. 40,000 and Rs. 10,000 respectively. Find the minimum sales value of the export order.

Solution :

(a) Budget for the year ending 31st March 1990

	As On 31-3-89	Volume Increase	Price Increase/ Decrease	Budget for 1990
Sales	Rs. <u>13,60,800</u>	30%	(-) by 5%	Rs. <u>16,80,588</u>
Direct Materials	4,00,000	(+) 30%	(-) by 5% discount	4,94,000
Direct Wages	2,80,000	(+) 30%	(+) 10%	4,00,400
Direct Expenses	20,000	(+) 30%	—	26,000
Factory OH				
Variable	70,000	(+) 30%	(+) 10%	1,00,100
Fixed	<u>70,000</u>			<u>70,000</u>
Factory Cost	<u>8,40,000</u>			<u>10,90,500</u>
Adm. OH	<u>1,68,000</u>		(-) 2 %	<u>1,64,640</u>
Cost of production	10,08,000			12,55,140
Selling Overheads:				
Variable	75,600	(+) 30%		98,280
Fixed	<u>50,400</u>		—	<u>50,400</u>
Cost of Sales	<u>11,34,000</u>			<u>14,03,820</u>
Profit	<u>2,26,800</u>			<u>2,76,768</u>

(b) *Overhead Recovery Rates :*

Factory Overhead (V)	25.00%	Direct Wages.
(F)	17.48%	Direct Wages.
Total	42.48%	Direct Wages
Adm. O.H.	15.10%	Factory Cost
Selling OH. Variable	9.01%	" "
Fixed	4.62%	" "
	13.63%	" "
Variable Factory Cost	Rs. 10,20 500	
Variable Selling OH Rate	9.63% of Variable Factory Cost	

(c) *Minimum Sales Value of Export Order.*

Direct Material	Rs. 50,000	
Direct Wages.	40,000	
Direct Expenses.	10,000	
Factory O.H.	<u>10,000</u>	25% of D. Wages.
Variable Factory Cost	1,10,000	
Selling Overhead (V)	<u>10,593</u>	9.63 of Variable Cost
Minimum Sales Value	<u>1,20,593</u>	

Problem 86. (Variance Analysis—Causes of decline in Profitability) Given below are the Budgeted and Actual Performance in 1988 Steady Growth Ltd. which sells three Products A, B & C

	Budget Rs. ('000)			Total
	A	B	C	
Sales (units)	1000	1000	2000	4000
	Rs.	Rs.	Rs.	Rs.
Sales	1000	2000	3000	6000
Variable Cost	<u>700</u>	<u>1600</u>	<u>2300</u>	<u>4600</u>
Margin	300	400	700	1400
Traceable fixed expense	<u>200</u>	<u>200</u>	<u>300</u>	<u>700</u>
Net Margin	100	200	400	700
Selling Adm. Exp.				<u>250</u>
Net Income				<u>450</u>

	Actual Rs. ('000)			Total
	A	B	C	
Sales (units)	800	1000	2100	3900
	Rs.	Rs.	Rs.	Rs.
Sales	810	2000	3000	5810
Variable Cost	<u>560</u>	<u>1610</u>	<u>2320</u>	<u>4490</u>
Margin	250	390	680	1320
Traceable fixed expense	<u>210</u>	<u>220</u>	<u>315</u>	<u>745</u>
Net Margin	40	170	365	575
Selling & Adm. Exp.				<u>275</u>
Net Income				<u>300</u>

The fall in Net Income to one-third below the budget level has caused all-round concern. What caused this decline in profitability?

You are required to proceed step by step and analyse the difference with more and more refinement by isolating the effects due to changes in the level of business activity from the effects due to changes in costs, prices and operating efficiencies. Based on your working, pinpoint causes for decline in profitability.

Solution :

Statement showing contribution made by different factors towards the changes in profit.

S. No	Reasons	Amount
1.	Profit decline due to adverse selling price variance	(-) Rs. 140,000
2.	Profit due to Sales Mix Variance	(+) 1,00,000
3.	Profit decline due to Sales Quantity Variance	(-) 35,000
4.	Profit due to Variable Cost Price Variance	(+) 85,000
5.	Profit decline due to Variable Cost Volume Variance	(-) 90,000
6.	Profit decline due to Fixed Overhead Expenditure Variance	(-) 45,000
7.	Profit decline due to increase in selling expenses	(-) 25,000
		(-) <u>1,50,000</u> [⊕]

[⊕] This explains why profit has decreased from Rs. 4,50,000 to Rs. 3,00,000.

Working Note

(SV₁) Actual Sales (Given)

A— 800 × Rs. 1012.50	=	Rs. 8,10,000
B— 1000 × 2000.00	=	20,00,000
C— <u>2100 × 1428.5714</u>	=	<u>30,00,000</u>
<u>3900</u>		<u>58,10,000</u>

(SV₂) Actual units sold at budgeted selling price.

A— 800 × Rs. 1000	=	Rs. 8,00,000
B— 1000 × Rs. 2000	=	20,00,000
C— <u>2100 × Rs. 1,500</u>	=	<u>31,50,000</u>
<u>3900</u>		<u>59,50,000</u>

(SV₃) Standard Sales Value of actual sales, if the sales had been in the ratio of standard sales mix.

A— (1000 + 4000) × 3900 × 1000	=	Rs. 9,75,000
B— (1000 + 4000) × 3900 × 2000	=	19,50,000
C— (2000 + 4000) × 3900 × 1500	=	<u>29,25,000</u>
		Rs. <u>58,50,000</u>

(SV₄) Standard Sales Value of Sales as per budget (Given) Rs. 60,00,000

1. *Sales Value Price Variance* = $SV_1 - SV_2$
= Rs. 58,10,000 – 59,50,000 = Rs. 1,40,000 (A)
2. *Sales Value Mix Variance* = $SV_2 - SV_3$
= Rs. 59,50,000 – Rs. 58,50,000 = Rs. 1,00,000 (F)
3. *Sales Value Quantity Variance* = $SV_3 - SV_4$
= Rs. 58,50,000 – Rs. 60,00,000 = 1,50,000 (A)
4. *Sales Value Volume Variance* = $SV_2 - SV_4$
= Rs. 59,50,000 – Rs. 60,00,000 = Rs. 50,000 (A)

Sales Value Price Variance contributes to change in profit fully. Impact of Sales Volume Variance on profit has been determined below:—

	<i>Sales levels</i>		<i>Difference</i>
Sales (units)	4000	3900	100
Variable Cost	Rs. 46,00,000	44,85,000	(1,15,000)
Fixed Exp. (including S. Exp)	<u>9,50,000</u>	<u>9,50,000</u>	<u>—</u>
	<u>55,50,000</u>	<u>54,35,000</u>	<u>(1,15,000)</u>
Sales	60,00,000	58,50,000	(1,50,000)
Profit	<u>4,50,000</u>	<u>4,15,000</u>	<u>(35,000) *</u>

* Reduction in Profit due to Sales Volume = Rs. 35,000

2. Impact of Variable Cost Variance

VO₁—Actual Variable Cost Incurred

- A 800 × Rs. 700 = 5,60,000
 B 1000 × Rs. 1610 = 16,10,000
 C 2100 × Rs. 1104.7619 = 23,20,000 Rs. 44,90,000
3900

VO₂—Variable Cost for actual units sold at standard v. cost rate.

- A 800 × (7,00,000 + 1000) = Rs. 5,60,000
 B 1000 × (16,00,000 + 1000) = 16,00,000
 B 2100 × (23,00,000 + 2000) = 24,15,000 45,75,000

VO₃—Variable Cost for the output

- (46,00,000 + 4000) × 3,900 = Rs. 44,85,000

3. Impact of Fixed expenses

- FO₁—Actual fixed expenses = Rs. 7,45,000
 FO₂—Budgeted fixed expenses = 7,00,000
 Fixed Overhead expenditure Variance FO₁ – FO₂
 = Rs. 7,45,000 – 7,00,000 = Rs. 45,000 (A)

4. Impact of selling expense.

- Actual Selling exp. = Rs. 2,75,000
 Budgeted exp. = 2,50,000
25,000 (A)

Note :— Please note that impact of sales volume quantity variance on profits is partial. All other variances contribute to change in profit equal to their magnitude.

For question on Transfer Price based on Market Price Method and Cost Method, please refer to problem 13.26.

For question on Inflation Accounting (Gearing Adjustment and Current Cost adjustment) please refer to Problem 14.9.

For question on use of Linear Regression Equation for estimation please refer to Problem 15.37.

For question on Minimax and Maximin criterion for Decision Making, please refer to Problem 15.38.

Problem 87. (Cost-benefit analysis of constructing an overpass)
Traffic lights control the flow of traffic across and between two busy highways A and B. It is estimated that 50% of the traffic on each highway is delayed; the average loss of time per car delayed is 1 minute on highway A and 1.2 minutes on highway B. The traffic on A averages 5000 cars a day and on B 4000. 20% of the cars are trucks and commercial vehicles, the rest are private. Whether on business or pleasure the occupants' time has to be viewed as valuable. The cost of time for commercial vehicles is estimated at Rs. 5 an hour and private at Rs. 2. The cost of a stop and start is estimated to be 6 paise per commercial and 4 paise per private cars. Two fatal accidents due to failure to obey traffic signals occurred in the last 4 years and the insurance settlements were Rs. 50,000 for each accident. Forty non-fatal accidents averaging a claim of Rs. 1,500 occurred in the same period. These accidents resulted from traffic light violations and will be eliminated by an overpass.

This overpass is designed to replace the intersection and will add a quarter of mile to the distance of 15% of the total traffic. The overpass will cost Rs. 7,50,000 and the extra maintenance will be Rs. 2,500 a year. The incremental operating cost for commercial vehicles will be 25 paise a mile and for non-commercial 6 paise a mile.

The cost of operating the traffic lights is Rs. 6,000 a year and a police man spends 2 hours a day at the crossing and the cost is apportioned at Rs. 3 per hour. No policeman will be needed at the overpass.

The expected economic life of overpass is 25 years with a salvage value of zero. The cost of Capital is 7% (The corresponding capital recovery factor is 0.0858). Compute the Benefit Cost Ratio.

Solution:

<i>Benefit to users</i>	<i>High ways</i>	
	<i>A</i>	<i>B</i>
Average time lost (minute)	1	1.2
Traffic (No. of cars per day)	5,000	4,000
Estimated traffic delayed	50 %	50 %
Trucks and commercial vehicles	20%	20%
Private Cars	80%	80%

<i>Cost of time (per hour)</i>	<i>Commercial</i>	<i>Private</i>
<i>Cost of a Stop and Start</i>	Rs. 5	Rs. 2
<i>Annual Savings</i>	Rs. 0.06	Rs. 0.04

- Highway A* : $(5,000 \times 365 \times 0.5 \times 1/60) (0.2 \times \text{Rs. } 5 + 0.8 \times \text{Rs. } 2)$
 $= 15208 \times 2.6 = \text{Rs. } 39540$ (i)

Highway B : $(4,000 \times 365 \times 0.5 \times 12/60) (0.2 \times \text{Rs. } 5 + 0.8 \times \text{Rs. } 2) =$
 $14600 \times 2.6 = \text{Rs. } 37,960$ (ii)

Total (i) + (ii) = Rs. 77,500
- Savings in stops and starts
 $(5,000 + 4,000) \times 365 \times 0.5 \times (0.2 \times 0.06 + 0.8 \times 0.04)$
 $16,42,500 \times 0.044 = \text{Rs. } 72,270$
- Savings in accidents
 $\left(\frac{2}{4} \times 50,000 + \frac{40}{4} \times 1,500 \right)$ Rs. 40,000

Total 1,89,770
- Less Cost of added distance
 $(5000 + 4000) (365 \times 0.15 \times 0.25) (0.2 \times 0.25 + 0.8 \times 0.06) =$
 $9,000 \times 13.6875 \times 0.098 = \underline{(12,070)^*}$

Net savings 1,77,700

* Rounded off to Rs. 10

Cost to State

Cost of investment	Rs. 7,50,000 \times 0.0858	=	Rs. 64,350
Maintenance			2,500
Savings in operations	$6,000 + (2 \times 365 \times 6000)/2,000$		<u>(8,190)</u>
			<u>58,660</u>
Benefit Cost Ratio =	$1,77,700 + 58,660$	=	3.03

CS Inter June 1989

For question on break-even points of two machines, please refer to Problem 9-22 on page P 9-37.

For question on Reconciliation of Costing Profit with Financial Profit, please refer to a similar Problem 4-6(a).

Problem 88. Movewell Ltd. is a distributor of bicycles. At 30th June, stock-in-hand was 200 units which had a value of Rs. 8,400.

Transactions for the six months to 31st December were as follows:

<i>Date</i>	<i>Purchase quantity (Units)</i>	<i>Cost per unit (Rs.)</i>
July	200	46.00
August	500	49.40
September	1,000	52.50 (net)

The purchase manager obtained a bulk purchase discount of Rs. 7.50 per unit on the September purchases.

<i>Date</i>	<i>Sale quantity (Units)</i>	<i>Unit sale price (Rs.)</i>
October	500	66.00
November	700	70.00
December	500	75.00

There were no sales during the first three months of the period. Using the FIFO, LIFO and cumulative weighted average methods of stock valuation, you are required to—

- show the stores ledger records, including the closing stock valuation;
- prepare trading accounts for the six months period, using each of the three valuation methods, and
- indicate which valuation method is the best measure of profit, and why?

Solution

(a) Store Ledger

(i) FIFO Method

<i>Month</i>	<i>Receipts</i>			<i>Issues</i>			<i>Balance</i>		
	<i>Units</i>	<i>Price</i>	<i>Value</i>	<i>Units</i>	<i>Price</i>	<i>Value</i>	<i>Units</i>	<i>Price</i>	<i>Value</i>
		<i>Rs.</i>	<i>Rs.</i>		<i>Rs.</i>	<i>Rs.</i>		<i>Rs.</i>	<i>Rs.</i>
Opening Balance	—	—	—	—	—	—	200	42.00	<u>8,400</u>
July	200	46.00	9,200	—	—	—	200	42.00	8,400
							200	46.00	<u>9,200</u>
									<u>17,600</u>
Aug.	500	49.40	24,700	—	—	—	200	42.00	8,400
							200	46.00	9,200
							500	49.40	<u>24,700</u>
									<u>42,300</u>
Sept.	1000	52.50	52,500	—	—	—	200	42.00	8,400
	—	—	—	—	—	—	200	46.00	9,200
	—	—	—	—	—	—	500	49.40	24,700
	—	—	—	—	—	—	1000	52.50	<u>52,500</u>
									<u>94,800</u>
Oct.	—	—	—	200	42.00	8,400	—	—	—
	—	—	—	200	46.00	9,200	—	—	—
	—	—	—	100	49.40	<u>4,940</u>	—	—	—
						<u>22,540</u>	400	49.40	19,760
	—	—	—	—	—	—	1000	52.50	<u>52,500</u>
									<u>2,260</u>
Nov.	—	—	—	400	49.40	19,760	—	—	—
	—	—	—	—	—	<u>15,750</u>	—	—	—
	—	—	—	300	52.50	<u>35,510</u>	700	52.50	36,750
Dec.	—	—	—	500	52.50	<u>26,250</u>	200	<u>52.50</u>	<u>10,500</u>

(ii) LIFO Method :

Month	Receipts			Issues			Balance		
	Units	Price	Value	Units	Price	Value	Units	Price	Value
		Rs.	Rs.		Rs.	Rs.		Rs.	Rs.
Opening Balance	—	—	—	—	—	—	200	42.00	8,400
July	200	46.00	9,200	—	—	—	200	42.00	8,400
							200	46.00	<u>9,200</u>
									<u>17,600</u>
Aug.	500	49.40	24,700	—	—	—	200	42.00	8,400
	—	—	—	—	—	—	200	46.00	9,200
	—	—	—	—	—	—	500	49.40	<u>24,700</u>
									<u>42,300</u>
Sept.	1000	52.50	52,500	—	—	—	200	42.00	8,400
	—	—	—	—	—	—	200	46.00	9,200
	—	—	—	—	—	—	500	49.40	24,700
	—	—	—	—	—	—	1000	52.50	<u>52,500</u>
									<u>94,800</u>
Oct	—	—	—	500	52.50	26,250	200	42.00	8,400
	—	—	—	—	—	—	200	46.00	9,200
	—	—	—	—	—	—	500	49.40	24,700
	—	—	—	—	—	—	500	52.50	<u>26,250</u>
									<u>68,550</u>
Nov.	—	—	—	500	52.50	26,250	—	—	—
						<u>9,880</u>			
	—	—	—	200	49.40	<u>36,130</u>	200	42.00	8,400
	—	—	—	—	—	—	200	46.00	9,200
	—	—	—	—	—	—	300	49.40	<u>14,820</u>
									<u>32,420</u>
Dec.	—	—	—	300	49.40	14,820	—	—	—
						<u>9,200</u>			
	—	—	—	200	46.00	<u>24,020</u>	200	42.00	8,400

(iii) Cumulative Weighted Average

Months	Receipts			Issues			Balance		
	Units	Price	Value	Units	Price	Value	Units	Price	Value
		Rs.	Rs.		Rs.	Rs.		Rs.	Rs.
Opening Balance	—	—	—	—	—	—	200	42.00	8,400
July	200	46.00	9,200	—	—	—	400	44.00	17,600
Aug.	500	49.40	24,700	—	—	—	900	47.00	42,300
Sept.	1000	52.50	52,500	—	—	—	1900	49.89	94,800
Oct.	—	—	—	500	49.89	24,945	1400	49.89	69,855
Nov.	—	—	—	700	49.89	34,923	700	49.90	34,932
Dec.	—	—	—	500	49.90	24,950	200	49.91	9,982

(b) Trading Account to the period 1 July - 31 December

		FIFO Rs.	LIFO Rs.	Weighted Rs.
Sales				
500 units @ Rs. 66-00	33,000			
700 units @ Rs. 70-00	49,000			
500 units @ Rs. 75-00	37,500	1,19,500	1,19,500	1,19,500
Add Closing Stock		10,500	8,400	9,982
		<u>1,30,000</u>	<u>1,27,900</u>	<u>1,29,482</u>
Less Purchases				
200 units @ Rs. 46-00	9,200			
500 Units @ Rs. 49-40	24,700			
1000 units @ Rs 52-50	52,500	(86,400)	(86,400)	(86,400)
	-- ----			
Opening Stock		(8,400)	(8,400)	(8,400)
		<u>-----</u>	<u>-----</u>	<u>-----</u>
Gross Profit		35,200	33,100	34,682
		<u>-----</u>	<u>-----</u>	<u>-----</u>

It is noticed that in this case the prices are increasing. LIFO is best method of stock valuation in a period of inflation because the price of materials charged against sales is the price closest to the current replacement value of the materials consumed. The profit and loss account is therefore charged with a cost which approximates to the cost of replacing the materials used and the profit is accordingly reduced. It is inappropriate to price materials lower and thereby increase profit when a portion of this 'profit' is required for material replacement.

C.I.M.A. (London), November

Problem 89. (Apportionment of Overhead—Repeated distribution and algebraic methods). A company re-apportions the costs incurred by two service cost centres, materials handling and inspection, to the three production cost centres of machining, finishing and assembly.

The following are the overhead costs which have been allocated and apportioned to the five cost centres :

	<i>Rs. '000</i>
Machining	400
Finishing	200
Assembly	100
Materials handling	100
Inspection	50

Estimates of the benefits received by each cost centre are as follows :

	<i>Machining</i>	<i>Finishing</i>	<i>Assembly</i>	<i>Materials handling</i>	<i>Inspection</i>
	%	%	%	%	%
Materials handling	30	25	35	—	10
Inspection	20	30	45	5	—

You are required to :

(a) calculate the charge for overhead to each of the three production cost centres, including the amounts re-apportioned from the two service centres, using :

- (i) the continuous allotment (or repeated distribution) method, and
- (ii) an algebraic method.

Solution (i) Repeated Distribution Method.

	<i>Machining</i>	<i>Finishing</i>	<i>Assembly</i>	<i>Materials handling</i>	<i>Inspection</i>
	<i>Rs.</i>	<i>Rs.</i>	<i>Rs.</i>	<i>Rs.</i>	<i>Rs.</i>
Initial cost	4,00,000	2,00,000	1,00,000	1,00,000	50,000
Reapportion :					
Materials handling	30,000	25,000	35,000	(1,00,000)	10,000
	4,30,000	2,25,000	1,35,000	—	60,000
Inspection	12,000	18,000	27,000	3,000	(60,000)
	4,42,000	2,43,000	1,62,000	3,000	—
Materials handling	900	750	1,050	(3,000)	300
	4,42,900	2,43,750	1,63,050	—	300
Inspection	60	90	135	15	(300)
	4,42,960	2,43,840	1,63,185	15	—
	5	4	6	(15)	—
	<u>4,42,965</u>	<u>2,43,844</u>	<u>1,63,191</u>		

(ii) Algebraic MethodLet materials handling = x Let inspection = y

$$x = 1,00,000 + 0.05y \quad \dots\dots\dots (1)$$

$$-y = 50,000 + 0.1x \quad \dots\dots\dots (2)$$

$$y = 20,00,000 - 20x \quad \dots\dots\dots (3) = (1) \times 20$$

$$0 = 20,50,000 - 19.9x \quad \dots\dots\dots (4) = (2) + (3)$$

$$x = 20,50,000 + 19.9 \quad \text{or } x = \text{Rs. } 1,03,015$$

$$y = 50,000 + 0.1 (1,03,015) \quad \dots\dots\dots (2)$$

$$= 50,000 + 10,301 \quad \text{or } y = \text{Rs. } 60,301$$

	<i>Machining</i> <i>Rs.</i>	<i>Finishing</i> <i>Rs.</i>	<i>Assembly</i> <i>Rs.</i>
Initial cost	4,00,000	2,00,000	1,00,000
(x) Materials handling	(0.3) 30,905	(0.25) 25,754	(0.35) 36,055
(y) Inspection	(0.2) 12,060	(0.3) 18,090	(0.45) 27,136
	<u>4,42,965</u>	<u>2,43,844</u>	<u>1,63,191</u>

Problem 90 (Working back actual or budgeted figures when variances are given) Q Limited operates a system of standard costing and in respect of one of its products which is manufactured within a single cost centre, the following information is given.

For one unit of product the standard material input is 16 litres at a standard price of Rs. 2.50 per litre. The standard wage rate is Rs. 5 per hour and 6 hours are allowed in which to produce one unit. Fixed production overhead is absorbed at the rate of 120% of direct wages cost.

During the last four-week accounting period :

The material price variance was extracted on purchase and the actual price paid was Rs. 2.45 per litre. Total direct wages cost was Rs. 1,21,500.

Fixed production overhead incurred was Rs. 1,50,000.

Variances	<i>Favourable</i>	<i>Adverse</i>
Direct material price	Rs. 8,000	
Direct material usage		Rs. 6,000
Direct labour rate		4,500
Direct labour efficiency	3,600	
Fixed production overhead expenditure		6,000

You are required to calculate for the four-week period :

- (i) budgeted output in units
- (ii) number of litres purchased,
- (iii) number of litres used above standard allowed,
- (iv) actual units produced,
- (v) actual hours worked, and
- (vi) average actual wage rate per hour.

Solution.**Standard Product Cost**

	<i>Rs. per unit</i>
1. Material (16 ltrs. \times Rs. 2.50)	40
2. Labour (6 hrs. \times Rs. 5)	30
3. Fixed Production overhead (120% of 2)	<u>36</u>
Total cost (Standard)	<u>106</u>

(i) Budgeted output

	Rs. 150,000
Less : Fixed production overhead	<u>6,000</u>
Adverse Expenditure variance	1,44,000
Budgeted overhead	36
Budgeted overhead per unit	4,000 units
Budgeted output (1,44,000 \div 36)	

(ii) Number of litres purchased

Direct material price variance	=	Rs. 8,000
Price variance per litre (Rs. 2.50 - 2.45)	=	0.05
Material purchased (litres) = Rs. 8,000 \div 0.05	=	1,60,000

(iii) Number of litres used above standard allowed

1. Direct material usage variance	Rs. 6,000
2. Standard rate per litre	2.50
Material used above standard allowed (1+2)	= 2,400 litres

(iv) Actual units produced

1. Actual direct wages cost	Rs. 1,21,500
2. Less : Direct wage cost variance (A)	
(Rs. 4,500 - 3,600)	<u>900</u>
3. Standard wage cost of output	1,20,600
4. Standard wage cost per unit (6 hrs \times Rs. 5)	30
5. Units produced (3 + 4)	4,020 units

(v) Actual hours worked

1. Actual direct wage cost	Rs. 1,21,500
2. Less : Direct labour rate variance (A)	<u>4,500</u>
3. Standard wage cost	1,17,000
4. Standard wage rate per hour	5
5. Hours worked (3 + 4)	23,400 hrs.

(vi) Average actual wage rate per hour

1. Actual direct wage cost	Rs. 1,21,500
2. Actual hours worked	23,400 hrs.
3. Average actual wage rate per hour (1 + 2)	Rs. 5.19 per hr.

Problem 91 (Normal and Abnormal Loss/Gain). A company using process costing manufactures a single product which passes through two processes, the output of process 1 becoming the input to process 2. Normal losses and abnormal losses are defective units having a scrap value and cash is received at the end of the period for all such units.

The following information relates to the four-week period of accounting period number 7.

Raw material issued to process 1 was 3,000 units at a cost of Rs. 5 per unit.

There was no opening or closing work-in-progress but opening and closing stocks of finished goods were Rs. 20,000 and Rs. 23,000 respectively.

	Process 1	Process 2
Normal loss as a percentage of input	10%	5%
Output in units	2,800	2,600
Scrap value per unit	Rs. 2	Rs. 5
Additional components	1,000	780
Direct wages incurred	4,000	6,000
Direct expenses incurred	10,000	14,000
Production overhead as a percentage of direct wages	75%	125%

You are required to present the account for :

- | | |
|-----------------------------------------------------------------------------------|--------------------|
| (i) Process 1 | (ii) Process 2 |
| (iii) Finished goods | (iv) Normal loss |
| (v) Abnormal loss | (vi) Abnormal gain |
| (vii) Profit and loss (so far as it relates to any of the accounts listed above). | |

Solution

Process 1 Account

	Units	Rs		Units	Rs.
To Raw material			By Output transferred		
@ Rs. 5	3,000	15,000	to process 2 A/c	2,800	33,600
" Additional components		1,000	" Normal loss (10%)	300	600
" Direct wages		4,000			
" Direct expenses		10,000			
" Production overhead		3,000			
" Abnormal gain					
@ Rs. 12*	100	1,200			
	<u>3,100</u>	<u>34,200</u>		<u>3,100</u>	<u>34,200</u>

*(Rs. 33,000 - 600) ÷ 2700 = Rs. 12

Process 2 Account

	Units	Rs.		Units	Rs.
To Process 1 A/c	2,800	33,600	By Finished goods	2,600	59,800
" Additional components		780	" Normal loss	140	700
" Direct Wages		6,000	" Abnormal loss		
" Direct Expenses		14,000	@ Rs. 23*	60	1,380
" Production Overhead		7,500			
	<u>2,800</u>	<u>61,880</u>		<u>2,800</u>	<u>61,880</u>

* $\frac{61,880 - 700}{2,600 + 60} = \text{Rs. } 23$

Finished Goods Account

	<i>Rs.</i>		<i>Rs.</i>
To Balance b/f	20,000	By Cost of sales*	56,800
" Process 2 A/c	<u>59,800</u>	" Balance c/f	<u>23,000</u>
	<u>79,800</u>		<u>79,800</u>

Normal Loss A/c

	<i>Units</i>	<i>Rs.</i>		<i>Units</i>	<i>Rs.</i>
To Process 1 A/c	300	600	By Abnormal Gain		
" Process 2 A/c	140	700	(Process 1)	100	200
" Abnormal loss A/c	<u>60</u>	<u>300</u>	" Cash	<u>400</u>	<u>1,400</u>
	<u>500</u>	<u>1,600</u>		<u>500</u>	<u>1,600</u>

Abnormal Loss A/c

To Process 2 A/c	<i>Rs.</i> 1,380	By Normal loss (60 × Rs 5)	<i>Rs.</i> 300
	<u>1,380</u>	" P & L A/c	<u>1,080</u>
			<u>1,380</u>

Abnormal Gain A/c

To Normal Loss (100 × Rs. 2)	<i>Rs.</i> 200	By Process A/c	<i>Rs.</i> 1,200
" P & L A/c	<u>1,000</u>		<u>1,200</u>
	<u>1,200</u>		

Profit & Loss A/c (Extract)

To Abnormal Loss A/c	<i>Rs.</i> 1080	By Abnormal Gain	<i>Rs.</i> 1,000
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Problem 92 (Absorption Costing vs Marginal Costing). A distribution and marketing organisation sells three products named A, B and C in two areas which are designated as Area 1 and Area 2. The information given below is for 1990.

Data :	<i>Product A</i>	<i>Product B</i>	<i>Product C</i>
Selling price per unit	<i>Rs.</i> 40	<i>Rs.</i> 48	<i>Rs.</i> 60
Purchase price per unit	32	36	44
Sales, in units :			
Area 1	92,000	40,000	28,000
Area 2	20,000	40,000	40,000
Number of orders :			
Area 1	40,000	20,000	10,000
Area 2	6,000	10,000	8,000
Volume in cubic metres per unit	2.0	1.5	1.0
Costs :	<i>Variable</i>	<i>Fixed</i>	<i>Basis of</i>
	<i>Rs. '000</i>	<i>Rs. '000</i>	<i>apportionment</i>
Selling	188	376	Number of orders
Warehousing/distribution	432	648	Volume sold
Advertising	270	540	Units sold
Administration	64	256	Sales value

* Balancing figure

You are required to

- (a) prepare a budget for 1990 showing the profit or loss for each area and in total, using absorption costing ; and
- (b) prepare a budget for Area 1 only, using marginal costing and showing relevant information for each product and the total profit or loss for that area.

Solution (a) Absorption Costing

(Rs. '000)

<i>Sales</i>	<i>Area 1</i>	<i>Area 2</i>	<i>Total</i>
A	3,680	1,200	4,880
B	1,920	1,920	3,840
C	<u>1,680</u>	<u>2,400</u>	<u>4,080</u>
	7,280	5,520	12,800
<i>Purchases</i>			
A	2,944	960	3,904
B	1,440	1,440	2,880
C	<u>1,232</u>	<u>1,760</u>	<u>2,992</u>
	<u>5,616</u>	<u>4,160</u>	<u>9,776</u>
Gross Profit	1,664	1,360	3,024
* Selling Costs (70 : 24)	420	144	564
* Warehousing (272 : 160)	680	400	1,080
* Advertising (160 : 110)	480	330	810
* Administration (728 : 5520)	<u>182</u>	<u>138</u>	<u>320</u>
	<u>1,762</u>	<u>1,012</u>	<u>2,774</u>
	(98)	348	250

(b) Area 1—Marginal Costing Statement

(Rs '000)

	<i>A</i>	<i>B</i>	<i>C</i>	<i>Total</i>
Sales	3,680	1,920	1,680	7,280
Less : Cost of Sales	<u>2,944</u>	<u>1,440</u>	<u>1,232</u>	<u>5,616</u>
Gross contribution	<u>736</u>	<u>480</u>	<u>448</u>	<u>1,664</u>
Less : Variable costs (selling & administration)				
Selling	80.0	40.0	20.0	140.0
Warehousing	184.0	60.0	28.0	272.0
Advertising	92.0	40.0	28.0	160.0
Administration	<u>18.4</u>	<u>9.6</u>	<u>8.4</u>	<u>36.4</u>
Net contribution	<u>361.6</u>	<u>330.4</u>	<u>363.6</u>	<u>1,055.6</u>
Less : Fixed cost (1,762—608.4)				<u>1,153.6</u>
Loss				(98)

* Both fixed and variable.

Problem 93 (Variance Analysis—Factors that Contributed to Change in Profit). The following statement has been produced for presentation to the general manager of Department X.

<i>Month ended 31st October 1989</i>			
	<i>Original budget Rs.</i>	<i>Actual result Rs.</i>	<i>Variance Rs.</i>
Sales	<u>6,00,000</u>	<u>5,50,000</u>	<u>50,000</u>
Direct materials	1,50,000	1,30,000	20,000
Direct labour	2,00,000	1,89,000	11,000
Production overhead :			
Variable with direct labour	50,000	46,000	4,000
Fixed	25,000	29,000	(4,000)
Variable selling overhead	75,000	72,000	3,000
Fixed selling overhead	<u>50,000</u>	<u>46,000</u>	<u>4,000</u>
Total costs	<u>5,50,000</u>	<u>5,12,000</u>	<u>38,000</u>
Profit	<u>50,000</u>	<u>38,000</u>	(12,000)
Direct labour hours	50,000	47,500	
Sales and production units	5,000	4,500	

Note : There are no opening and closing stocks.

The general manager says that this type of statement does not provide much relevant information for him. He also thought that the profit for the month would be well up to budget and was surprised to see a large adverse profit variance.

You are required to :

- re-draft the above statement in a form which would be more relevant for the general manager;
- calculate all sales, material, labour and overhead variances and reconcile to the statement produced in (a).

Solution

<i>Month ended 31st October 1989</i>				
	<i>Original Budget</i>	<i>Flexible Budget</i>	<i>Actual Results</i>	<i>Variance against flexible budget</i>
Units	<u>5,000</u>	<u>4,500</u>	<u>4,500</u>	—
Sales	Rs. 6,00,000	Rs. 5,40,000	Rs. 5,50,000	Rs. 10,000 (F)
<i>Less : Variable Cost</i>				
Direct Materials	1,50,000	1,35,000	1,30,000	5,000 (F)
Direct Labour	2,00,000	1,80,000	1,89,000	9,000 (A)
<i>Production Overhead :</i>				
Variable Prod. O.H.	50,000	45,000	46,000	1,000 (A)
Variable Selling O.H.	<u>75,000</u>	<u>67,500</u>	<u>72,000</u>	<u>4,500 (A)</u>
Total Variable Cost	<u>4,75,000</u>	<u>4,27,500</u>	<u>4,37,000</u>	<u>2,500 (A)</u>
Contribution	1,25,000	1,12,500	1,13,000	500 (F)
<i>Less : Fixed O.H. Prod.</i>	25,000	25,000	29,000	4,000 (A)
Fixed O.H. Selling	<u>50,000</u>	<u>50,000</u>	<u>46,000</u>	<u>4,000 (F)</u>
Profit	<u>50,000</u>	<u>37,500</u>	<u>38,000</u>	<u>500 (F)</u>

Profit Variance :

Volume variance between
original budget and flexi-
ble budget

$$(50,000 - 37,500) = 12,500 \text{ (A)}$$

Volume variance between
Flexible budget and actual

$$(37,500 - 38,000) = \underline{500 \text{ (F)}}$$

Total profit variance as per original

$$\underline{\underline{12,000 \text{ (A)}}}$$

(b) Variances Against Flexible Budget Reconciliation with (a)**1. Sales Margin Price Variances**

SM₁—Actual Sales Margin on Actual Sales =

$$\text{Rs. } 5,50,000 - (\text{Rs. } 110 \times 4,500) = \text{Rs. } 55,000$$

SM₂—Standard Sales Margin on Actual Sales

$$= (4,500 \times \text{Rs. } 120) - (4,500 \times 110) = \text{Rs. } 45,000$$

There is no mix variance and volume variance with reference
to flexed budget.

∴ Sales Margin Price Variance

$$= \text{SM}_1 - \text{SM}_2 = \text{Rs. } 55,000 - \text{Rs. } 45,000 \quad \text{Rs. } 10,000 \text{ (F)}$$

2. Direct Material Cost Variance (as per statement) Rs. 5,000 (F)

(Detailed direct material cost variance not attempted since
units of material input or weight not given)

3. For Direct Wage Variance

L₁—Actual payment made to workers for actual hours worked
(Given) = Rs. 1,89,000

L₂—Payment involved if the workers had been paid at
standard rate (47,500 hrs × Rs. 4) = Rs. 1,90,000

L₅—Standard labour cost of output (4,500 units × 10 hrs ×
Rs. 4) = Rs. 1,80,000

Wage Rate Variance = L₁ - L₂ = Rs. 1,89,000 - Rs. 1,90,000 Rs. 1,000 (F)

Wage Efficiency Variance = L₂ - L₅ =

$$\text{Rs. } 1,90,000 - \text{Rs. } 1,80,000 \quad \text{Rs. } 10,000 \text{ (A)}$$

4. Variable Production Overhead

VO₁ Actual Variable Overhead = Rs. 46,000

VO₂—Actual hours worked at Standard Variable O.H. rate

$$47,500 \text{ hrs} \times \text{Rs. } 1 \quad \text{Rs. } 47,500$$

VO₃—Standard Variable O.H. for the production

$$45,000 \text{ units} \times 10 \text{ hrs} \times \text{Rs. } 1 = \text{Rs. } 45,000$$

Variable O.H. Expenditure Variance

$$= VO_1 - VO_2 = \text{Rs. } 46,000 - \text{Rs. } 47,500 = \text{Rs. } 1,500 \text{ (F)}$$

V.O.H. Efficiency Variance

$$= VO_2 - VO_3 = \text{Rs. } 47,500 - \text{Rs. } 45,000 = \text{Rs. } 2,500 \text{ (A)}$$

Variable Selling O.H. Variance

VO₁ – Actual V.O. incurred Rs. 72,000

VO₂ – Actual hours at standard variable O.H. rate

$$47,500 \times \text{Rs. } 1.5 = \text{Rs. } 71,250$$

VO₃ – Standard Variable O.H. for the production

$$4,500 \text{ units} \times 10 \text{ hrs} \times \text{Rs. } 1.5 = \text{Rs. } 67,500$$

$$\text{Expenditure Variance} = VO_1 - VO_2 = \text{Rs. } 72,000 - 71,250 = 750 \text{ (A)}$$

$$\text{Efficiency Variance} = VO_2 - VO_3 = \text{Rs. } 71,250 - 67,500 = 3,750 \text{ (A)}$$

Fixed Production O.H.

FO₁ – Actual Fixed O.H. incurred Rs. 29,000

FO₂ – Budgeted Fixed Overhead Rs. 25,000

$$\begin{aligned} \text{Fixed Production Overhead Expenditure Variance} &= FO_1 - FO_2 \\ &= \text{Rs. } 29,000 - \text{Rs. } 25,000 = \text{Rs. } 4,000 \text{ (A)} \end{aligned}$$

Fixed Selling Overhead :

FO₁ — Actual Fixed O.H. incurred Rs. 46,000

FO₂—Budgeted Fixed OH. Rs. 50,000

$$\begin{aligned} \text{Fixed Selling O.H. Expenditure Variance } FO_1 - FO_2 \\ = \text{Rs. } 46,000 - \text{Rs. } 50,000 = \underline{4,000 \text{ (F)}} \end{aligned}$$

$$\text{Total Variance against flexible budget} = \underline{\underline{500 \text{ (F)}}}$$

Variances flexible budget against original

Sales Margin Volume Variance

$$\begin{aligned} SM_2 - \text{Sales Margin as per flexible budget} \\ 4,500 \times \text{Rs. } 10 = \text{Rs. } 45,000 \end{aligned}$$

$$\begin{aligned} SM_4 - \text{Sales Margin as per budget} \\ 5,000 \times \text{Rs. } 10 = \text{Rs. } 50,000 \end{aligned}$$

$$\text{Sales Margin Volume Variance} = \text{Rs. } 45,000 - 50,000 = \text{Rs. } 5,000 \text{ (A)}$$

Fixed Production Overhead

FO₂ – Budgeted Fixed Overhead = Rs. 25,000

FO₃ – There is no idle time variance. For FO₄, base value will be FO₃

$$\begin{aligned} FO_4 - \text{Fixed Overhead for hours worked at standard rate} \\ 47,500 \text{ hrs} \times \text{Rs. } 0.5 = 23,750 \end{aligned}$$

FO ₅ – Standard fixed overhead for production	
4,500 units × Rs. 5	22,500
Fixed Production Overhead Capacity Variance = FO ₃ – FO ₄	
= Rs. 25,000 – Rs. 23,750	1,250 (A)
Fixed Production O.H. Efficiency Variance = FO ₄ – FO ₅	
= Rs. 23,750 – Rs. 22,500	1,250 (A)
<i>Fixed Selling O.H. Variance</i>	
FO ₂ – Budgeted F.O.	Rs. 50,000
FO ₅ – Standard F.O. for sales (4,500 × Rs. 10)	45,000
Fixed Selling O.H. Volume Variance	
= Rs. 50,000 – Rs. 45,000	<u>5,000 (A)</u>
	<u>12,500 (A)</u>

Note : (i) Alternative presentations are permissible.

(ii) All volume variances are to be included in the reconciliation of flexible budget and original budget.

Problem 94 (Formulation and Interpretation of Simplex Tableau). D Electronics produces three models of satellite dishes—Alpha, Beta and Gamma—which have contributions per unit of Rs. 40, Rs. 200 and Rs. 100 respectively.

There is a two-stage production process and the number of hours per unit for each process are :

	Alpha	Beta	Gamma
Process 1	2	3	2.5
Process 2	3	2	2

There is an upper limit on process hours of 1,920 per period for Process 1 and 2,200 for Process 2.

The Alpha dish was designed for a low-power satellite which is now fading and the sales manager thinks that sales will be no more than 200 per period.

Fixed costs are Rs. 40,000 per period.

You are required to :

(a) formulate these data into a Linear Programming model using the following notation :

x_1 : number of Alphas
 x_2 : number of Betas
 x_3 : number of Gammas

(b) formulate (but do not attempt to solve) the initial Simplex Tableau using

x_4 as Slack for Process 1
 x_5 as Slack for Process 2
 x_6 as Slack for any sales limit

and describe the meaning of Slack;

(c) interpret the final Simplex Tableau below

	x_1	x_2	x_3	x_4	x_5	x_6	<i>Solution</i>
x_2	0	1	0.83	0.33	0	-0.67	506.7
x_3	0	0	0.33	-0.67	1	-1.67	586.7
x_1	1	0	0	0	0	1	200
Z	0	0	66.67	66.67	0	266.7	181,333.3

(d) investigate the effect on the solution of each of the following :

- (i) an increase of 20 hours per period in Process 1,
- (ii) an increase of 10 units per period in the output of Alpha,
- (iii) receiving an order, which must be met, for 10 units of Gamma.

Solution (a) Model formulation

Maximise $400x_1 + 200x_2 + 100x_3$

Subject to

(Process 1) $2x_1 + 3x_2 + 2.5x_3 \leq 1,920$

(Process 2) $3x_1 + 2x_2 + 2x_3 \leq 2,200$

(Alpha sales) $x_1 \leq 200$

$x_1, x_2, x_3 \geq 0$

(b) Initial Simplex Tableau

	x_1	x_2	x_3	x_4	x_5	x_6	<i>Solution</i>
x_4	2	3	2.5	1	0	0	1,920
x_5	3	2	2	0	1	0	2,200
x_6	1	0	0	0	0	1	200
Z	400	200	100	0	0	0	0

A slack variable, in the example, represents unused resources (x_4 and x_5) and unused sales potential (x_6)

(c) Interpretation of final Tableau

The solution column gives the optimum production plan :

200 Alpha (x_1)

506.7 Beta (x_2)

0 Gamma

giving a contribution of Rs. 181,333.3.

586.7 hours of Process 2 (x_5) are unused.

All Process 1 hours are used.

The shadow prices in the Z row mean the following :

x_3 66.7 means that if any Gamma were produced, contribution will fall by Rs. 66.67 per unit.

x_4 66.7 means that extra Process 1 hours would increase contribution by Rs. 66.67.

x_6 266.7 means that every Alpha sale above 200 would increase contribution by Rs. 266.7.

(d) (i) For an increase of 20 hours in Process 1 (x_4), use multiplier in Col. x_4 .

	Original value	Multiplier	Revised value
x_2	506.7	$+ (0.33 \times 20) =$	513.3
x_5	586.7	$+ (-0.67 \times 20) =$	573.3
x_1	200	$+ (0 \times 20) =$	200
Z	181,333.3	$+ (66.7 \times 20) =$	182,666.7

Thus contribution increases by Rs. 1,333.4 to Rs. 182,666.7. Output of Beta (x_2) increases by 6.6 units, and 13.4 more hours of Process 2 (x_5) will be used.

(ii) For an increase of 10 units Alpha (x_1) production, use multipliers in Col. x_6 .

	Original value	Multiplier	Revised value
x_2	506.7	$+ (-0.67 \times 10) =$	500
x_5	586.7	$+ (-0.67 \times 10) =$	570
x_1	200	$+ (1 \times 10) =$	210
Z	181,333.3	$+ (266.7 \times 10) =$	184,000.3

Thus contribution increases by Rs. 2,667 to Rs. 184,000.3. Output of Beta (x_2) increases by 6.7 units, output of Alpha by the required 10 units, and 16.7 more Process 2 (x_5) hours will be used.

(iii) For the introduction of 10 units of Gamma (x_3), use multipliers in Col. x_3 .

Note : Forcing a real variable (x_1 , x_2 , x_3) reduces contribution.

	Original value	Multiplier	Revised value
x_2	506.7	$- (0.83 \times 10) =$	498.4
x_5	586.7	$- (0.33 \times 10) =$	583.4
x_1	200	$- (0 \times 10) =$	200
Z	181,333.3	$- (66.67 \times 10) =$	180,666.6

Thus contribution falls by Rs. 666.7 to Rs. 180,666.6. Output of Beta (x_2) falls by 8.3 units, and 3.3 more Process 2 (x_5) hours will be used.

Problem 95 (Make or Buy—Limiting Factor Approach). A B Ltd manufactures a picnic table which has three components, X, Y and Z, one of each being required for each table. The company is working to its full machine capacity of 28,000 hours per period and the machinery used is capable of making all the components.

The tables are made in *batches of 20* and data relating to current production are :

Per batch of 20

Components	Machine hours	Variable costs Rs.	Fixed costs Rs.	Total costs Rs.
X	6	15	6	21
Y	10	18	7	25
Z	<u>12</u>	18	18	36
	28			
Assembly		<u>32</u>	<u>13</u>	<u>45</u>
		83	44	127
		Profit		23
				<u>150</u>
			Selling Price	

Over the next budget period the machine capacity cannot be increased although the assembly capacity can be increased as required. The budget for the next period is being prepared. Because sales are buoyant the purchase of one of the components is being considered and the following quotation has been received :

Batches of 20

Component	Price
X	Rs. 22
Y	28
Z	32

The company has decided that only one component will be bought outside in any one period. The sales director thinks that he could sell at least 50% more tables than at present and probably 75% more provided that the production capacity was available.

You are required to :

- recommend which component should be bought outside if production is increased by 50% and how many components should be bought;
- recommend which component should be bought outside if production is increased by 75% and how many components should be bought.

Solution : (a) and (b)

(Per batch of 20 tables)

Components	Price quoted	Variable Cost	Contribution	Machine Hours	Contribution per machine hour.
X	Rs. 22	Rs. 15	Rs. 7	6	Rs. 1.17
Y	28	18	10	10	1.00
Z	32	18	14	12	1.17

Machine capacity is the limiting factor in the present case. As the contribution from Y per hour is the lowest, the same should be purchased from the outside. Number of batches produced = $28,000 \text{ hrs} \div 28 = 1,000 \text{ hrs}$. If sales director's target of 50% increase in sales is achieved, the hours allocated will be as under :

Available hours	= 28,000
Less : Required to make X ($1,500 \times 6 \text{ hrs.}$)	(9,000)
Required to make Z ($1,500 \times 12 \text{ hrs.}$)	(18,000)
Balance hours required to make Y ($100 \times 10 \text{ hrs}$)	<u>(1,000)</u>

Therefore 1,400 components of Y should be purchased. To achieve 75% increase in sales, the only option is to sub-contract Z, and this balances exactly.

Available hours	28,000
Less : Required to make X ($1,750 \times 6 \text{ hrs.}$)	(10,500)
Required to make Y ($1,750 \times 10$)	<u>(17,500)</u>

Purchase 1,750 components of Y.

Problem 96 (Simulation through Random Numbers). The AB Travel Agency deals with numerous personal callers each day and prides itself on its level of service. The time to deal with each caller depends on the client's requirements which range from, say, a request for a brochure to booking a round-the-world cruise. If clients have to wait more than 10 minutes for attention it is AB's policy for the manager to see them personally and to give them Rs. 5 holiday voucher.

Observations have shown that the time taken to deal with clients and their arrival patterns follow distributions below :

Time to deal with clients	Minutes	2	4	6	10	14	20	30
	Probability	0.05	0.10	0.15	0.30	0.25	0.10	0.05 = 1.00
Time between arrivals	Minutes	1	8	15	25			
	Probability	0.2	0.4	0.3	0.1			= 1.00

You are required to :

- (a) describe how you would simulate the operation of the Travel Agency based on the use of Random Number Tables;
- (b) simulate the arrival and serving of 12 clients and show the number of customers who receive a voucher (use line 1 of the Random Numbers below to derive the arrival pattern and Line 2 for the serving times);

Random Numbers

Line 1 03 47 43 73 86 36 96 47 36 61 46 98
 Line 2 63 71 62 33 26 16 80 45 60 11 14 10

- (c) calculate the weekly cost of vouchers, assuming the proportion receiving vouchers derived from (b) applies throughout a week of 50 opening hours.

Solution. (a) The problem is analysed to determine the objective (establishing voucher cost) and uncontrolled variables (arrival time and service time) and the simulation logic. Random numbers are then assigned to represent the probability distribution given and then a random number table is used to select according to the probability, the value of servicing time and the time between arrivals. The working sheet would then be used [see (b)] to log arrival time and serving time (both randomly selected) and to show waiting time for individual clients.

Time to deal with clients

<i>Time</i>	<i>Probability</i>	<i>Cumulative Probability</i>	<i>Assigned numbers</i>
2 minutes	0.05	0.05	00-04
4 minutes	0.10	0.15	05-14
6 minutes	0.15	0.30	15-29
10 minutes	0.30	0.60	30-59
14 minutes	0.25	0.85	60-84
20 minutes	0.10	0.95	85-94
30 minutes	0.05	1.00	95-99

Time to deal with clients

<i>Time</i>	<i>Probability</i>	<i>Cumulative Probability</i>	<i>Assigned numbers</i>
1 minute	0.2	0.2	00-19
8 minutes	0.4	0.6	20-29
15 minutes	0.3	0.9	60-89
25 minutes	0.1	1.0	90-99

(b)

Work sheet

Client	Time between arrivals*	Arrival time	Serving			Time waiting	Voucher
			In	Time**	Out		
1	1	1	1	14	15	—	
2	8	9	15	14	29	6	
3	8	17	29	14	43	12	√*
4	15	32	43	10	53	11	√*
5	15	47	53	6	59	6	
6	8	55	59	6	65	4	
7	25	80	80	14	94	—	
8	8	88	94	10	104	6	
9	8	96	104	14	118	8	
10	15	111	118	4	122	7	
11	8	119	122	4	126	3	
12	25	144	144	4	148	—	

* derived from line 1 and assigned numbers

** derived from line 2 and assigned numbers

$$(c) \text{ Total clients in week} = \frac{50 \text{ hours}}{\text{average time between arrivals}}$$

Average time between arrivals :

Probability	Time	Equated Time
0.2	1 minute	0.2
0.4	8 minutes	3.2
0.3	15 minutes	4.5
0.1	25 minutes	2.5
1.0		<u>10.4</u> minutes average time

$$\text{Total clients in week} = (50 \times 60) / 10.4 = 288$$

2/12 clients receive Rs. 5 vouchers.

$$\text{Cost} = 2/12 \times 288 \times 5 = \text{Rs. 240}$$

Problem 97 (Sales and Pricing Option with different mark-ups). PT Ltd supplies an imported consumable component to distributors who, in turn, sell it to industrial users.

PT Ltd's selling prices range from Re. 0.40 to around Rs. 5.00 per 100 according to size. There is a range of about 600 items, available in two materials. The cost of the components from PT Ltd's suppliers, and similarly the selling price to its customers, is lower as the quantity bought increases.

Market research has shown that an important factor in the ability to sell this component is its availability for quick delivery (especially *ex stock*). This is

* 2 out of 12 clients receive Rs. 5 holiday vouchers.

particularly so for small orders (say, under 500) but much less so for large quantities where prices are keen and crucial to the purchase from any supplier.

PT Ltd has made a speciality of holding very large stocks and has always been in a strong position to give quick delivery. However, it charges about one-and-a-half times the prices of its competitors on the grounds that customers for small quantities (average price Re. 60 per 100) will be prepared to pay for quick delivery. In consequence, PT Ltd is a peripheral supplier, used mainly for small quantities when quick delivery is crucial. It currently holds about 3% to 5% of the market.

PT Ltd buys from two major sources overseas. Supplier A is extremely cheap, and is PT Ltd's major supplier. However, A will sell to almost any customer, including PT Ltd's competitors, though such customers will need to place a large enough order to justify importing.

Supplier B, though more expensive than A, holds very large stocks and can generally offer quicker delivery. Until two years ago it was PT Ltd's main supplier, but it has recently established a UK company, B(UK) Ltd, through which all sales to the UK will be placed.

PT Ltd is about to review its selling prices. It is concerned that B(UK) Ltd will, by holding large stocks in the UK, be able to offer distributors quick delivery at selling prices below those of PT Ltd, yet still make a good margin. There is still some doubt as to how much B(UK) Ltd will wish to invest in stock.

At present PT Ltd sets selling prices at a mark-up of 150% to 220% on its costs from A. This mark-up yields a contribution roughly equal to PT Ltd's total overheads, while other products not connected with the components provide a further contribution that makes PT Ltd a profitable company.

You are required to :

- (a) list three major options available to PT Ltd regarding its selling prices if it is to increase its profit from the sales of the component. In respect of each option, explain what you consider would be its major effects on PT Ltd's sales, costs and profit;
- (b) recommend the pricing option that you consider should be adopted, giving briefly the main reasons for your choice.

Solution : (a) With the establishment of B(UK) Ltd, there will be increased competition for PT Ltd. Therefore, to increase profit from the components sales, PT Ltd. has the following pricing options :

- (i) Reduce prices to attract a larger volume of sales.
- (ii) Increase prices and offer better service.
- (iii) Reduce prices of some components and increase others after analysing the existing sales and profit figures.

(i) **Reduce Prices :** This step will evidently result in higher sales volume. Fixed cost per unit will be reduced. PT Ltd is at present charging 1.5 times of its competitors. If it were to reduce to the same prices and if this doubled sales, the contribution would be less.

For example :

	<i>Sales</i>	<i>Cost</i>	<i>Mark-up</i>	
Present	Rs. 285**	Rs. 100	Rs. 185	(150 + 220) + 2
Revised	$285 \times 2 \times 2/3 = 380$	200*	180	*By doubling

In this case, the mark-up has come down and as such possibility of doubling sales is unlikely. Therefore, by adopting 20% price reduction of 50% sales increase, the final effect would be :

	<i>Sales</i>	<i>Cost</i>	<i>Mark-up</i>
Rs. 285 × 1.5 × 0.8	= Rs. 342	Rs. 150	Rs. 192

This gives an increased contribution of nearly 4% against which must be set some increase in overhead incurred in obtaining, handling, stocking and accounting for the extra sales. This does not seem a very feasible option.

(ii) **Increase Prices.** As PT Ltd. is already charging 1.5 times competitor's prices, it would need to provide a much better service to justify a further increase. This appears to be mainly dependent on increasing stock-holding to provide quicker service. This would be expensive with high interest rates and high space rentals. Initially the higher prices might reduce sales. The revised position with a 10% price increase and a 10% sales reduction would be :

	<i>Sales</i>	<i>Cost</i>	<i>Mark-up</i>
Rs. 285 × 0.9 × 1.1	= Rs. 282	Rs. 90	Rs. 192

This again gives an increased contribution of about 4% to cover the cost of higher stock-holding.

(iii) **Reduce some prices and increase others.** This option would require a full analysis of existing sales. This would show sales and profits by : (a) type of components; (b) sizes of components; (c) customers according to individual sales; and (d) customers according to total sales per month, etc. This would enable decisions to be made such as :

- price reduction for fast moving items.
- price increase for slow moving items.
- surcharging customers with small orders which are made at irregular intervals.
- offering quantity discounts to customers who place substantial monthly orders.

These discounts/surcharges should be small/large orders, additional/reduced stock-holdings, etc.

(b) **Recommendation :** I would recommend the variable price change option to be adopted. It is unlikely that general price increase or reduction would increase total profit. Selective application of price changes, related to service actually provided, would give an excellent chance to review other profit

** Sales = Cost + Mark-up, i.e., Rs. 100 + Rs. 185 = Rs. 285.

opportunities. For example, at present B does *not* supply small orders due to import problems. If approached it might let PT Ltd. handle all small orders for B (UK) Ltd. PT Ltd. might negotiate with B(UK) Ltd. to hold some B(UK) Ltd. stocks at its premises to service these orders. Payment should be made on an imprest system as stock is replaced. Alternatively, perhaps B(UK) Ltd. could stock metric sizes only in some of the least used sizes. PT Ltd. should stock the UK sizes. All these ideas could lead to higher profits through selective selling.

Problem 98 (Buy or Lease using DCF Technique). RS Ltd is considering using a machine made by BC Ltd. The machine would cost Rs. 60,000 and at the end of a four-year life is expected to have a resale value of Rs. 4,000, the money to be received in year 5. It would save Rs. 29,000 per year over the method that RS Ltd currently uses. RS Ltd expects to earn a DCF return of 20% before tax on this type of investment.

RS Ltd is currently earning good profits, but does not expect to have Rs. 60,000 available to spend on this machine over the next few years. It is subject to corporation tax at 35% and receives capital allowances of 25% on a reducing balance basis.

You are required to

- recommend whether, from an economic viewpoint, RS Ltd should invest in the machine from BC Ltd;
- calculate which of the following options RS Ltd would be financially better off to adopt :

Option 1—Buy the machine and borrow the Rs. 60,000 from the bank, repaying at the end of each year a standard annual amount that would comprise principal and interest at 20% per annum;

- or *Option 2*—Lease the machine for four years at an annual lease payment equal to the annual amount it would need to pay the bank under *Option 1* above;

Show your calculations.

Note : Assume that lease payments or loan repayments are made gross at the end of each year and that tax is paid and tax allowances received one year after those profits are earned.

Working Notes :

1. It should be kept in mind that RS Ltd is already earning good profit. Capital allowance received by it will reduce its profit resulting in tax benefit @ 35%. Similarly capital loss at the end of 4th year will also reduce its profit resulting in tax benefit.

2. DCF return of 20% before tax is equal to 13% after tax as is calculated below :

Suppose profit	= Rs. 100
Corporate tax	<u>35</u>
Profit after tax	<u>65</u>

∴ 20% of Rs. 65 = Rs. 13 or 13% after tax.

Solution

(a) (i) Statement showing discounted net cash flow, if investment is made in the machine from RS Ltd.

(Rs. in '000)

Year	Investment	Income	Tax on Income 35%	Tax benefit (Refer to table a(ii) Col 3)	Net Cash flow	13% discounting factor @	Discounted net cash flow
0	(60.0)	—		—	(60.0)	1.0	(60.0)
1	—	29.0		—	29.0	0.88	25.5
2	—	29.0	(10.15)	5.2	24.1	0.78	18.8
3	—	29.0	(10.15)	3.9	22.8	0.69	15.7
4	—	29.0	(10.15)	2.9	21.8	0.61	13.3
5	4.0	—	(10.15)	7.5	1.3	0.54	0.7
							<u>14.0</u>

As there is a positive discounted cash flow, RS Ltd should invest in this machine.

@ Refer to table showing the present value of one rupee for discounting factors to be applied.

(a) (ii) Table showing the tax benefit due to Capital Reserve and Capital Loss :

Year	Balance available at the beginning of the year	Capital allowance Reserve @ 25% on Col. 2	Tax benefit due to capital allowance Reserve @ 35% on Col 2	Reducing Balance (Col. 2-Col.3)
1	2	3	4	5
1	60,000	15,000	5,250	45,000
2	45,000	11,250	3,938	33,750
3	33,750	8,438	2,953	25,312
4	25,312	6,328	⊗ 2,214 5,245	18,984
			<u>7,459</u>	

⊗ Written down value after allowing deduction for Capital allowance for 4 years continuously

= 18,984

Less Resale Value

4,000

14,984

As this will be allowed as deduction in tax, it will result in tax benefit as follows :

Rs. 14,984 × 0.35 = Rs. 5,244.

(b) Equal annual repayment at the end of each year representing standard amount that would comprise principal and interest at 20% per annum for four years:

Rs. 60,000 ÷ Rs. 2.59@ = Rs. 23,166

@ This is an annuity factor. Refer to table showing present value of an annuity @ Re. 1.

Statement showing split of investment and capital repayment.

Year	Principal outstanding at the beginning	Interest at 20%	Annual repayment	Amount available to repay principal in the annual investment	Balance outstanding
0	Rs. 60,000	—	—	—	Rs. 60,000
1	60,000	Rs. 12,000	Rs. 23,166	Rs. 11,166	48,834
2	48,834	9,767	23,166	13,399	35,435
3	35,435	7,087	23,166	16,079	19,356
4	19,356	3,871	23,166	19,295*	—

* This is rounding off difference.

Option 1: Using a Bank loan to purchase the machine.

Year	Annual payment	Tax benefit due to interest deduction @	Tax benefit due to capital allowance Reserve Refer to table a(ii)]	Net Cash flow	Discounted Factor at 13%	Discounted net cash flow
	Rs.	Rs.	Rs.	Rs.		Rs.
1	(23,166)	—	—	(23,166)	0.88	(20,386)
2	(23,166)	4,200	5,250	(13,716)	0.78	(10,698)
3	(23,166)	3,418	3,938	(15,810)	0.69	(10,909)
4	(23,166)	2,479	2,953	(17,734)	0.61	(10,818)
5	4,000	1,355	7,459	12,814	0.54	6,920
						<u>(45,891)</u>

@ Refer to preceding table (interest column)

$$\text{Rs. } 12,000 \times 0.35 = \text{Rs. } 4,200$$

$$\text{Rs. } 9,767 \times 0.35 = \text{Rs. } 3,418$$

$$\text{Rs. } 7,087 \times 0.35 = \text{Rs. } 2,479$$

$$\text{Rs. } 3,871 \times 0.35 = \text{Rs. } 1,355$$

Option 2 : Lease for four years at Rs. 23,166 per year

Year	Annual Payment	Tax benefit due to annual loan payment @ 35%	Net Cash flow	Discounting factor at 13%	Discounted net cash flow
1	(Rs. 23,166)	—	(Rs. 23,166)	0.88	(Rs. 20,386)
2	(Rs. 23,166)	Rs. 8,108	(Rs. 15,058)	0.78	(Rs. 11,745)
3	(Rs. 23,166)	Rs. 8,108	(Rs. 15,058)	0.69	(Rs. 10,390)
4	(Rs. 23,166)	Rs. 8,108	(Rs. 15,058)	0.61	(Rs. 9,186)
5	—	Rs. 8,108	Rs. 8,108	0.54	4,378
					<u>(47,329)</u>

Conclusion : By comparing the discounted net cash flow under options 1 and 2, it is noted that use of bank loan to purchase the machine is the least-

cost solution. RS Ltd would financially be better-off to use this method. This conclusion is based on the basic assumption that RS Ltd is already a profit making organization and payment of interest, lease or deduction for capital reserve will result in tax benefit.

Problem 99 (Profit Centre Approach to Transfer Pricing). A boatyard is divided into three profit centres whose managers are rewarded according to results. Transactions between these profit centres are frequent.

Sales centre (S) buys and sells new boats.

If it needs to take part-exchange from a customer in order to sell a new boat, it transfers the part-exchanged boat to B at an agreed price.

Brokerage (B) buys and sells second-hand boats

- (i) in part-exchange from S (B names the price at which it can buy a comparable boat that is in a suitable condition for resale to an end-user customer, but deducts the likely cost of repairs) and
- (ii) from other sources, on a normal trading basis.

Repairs (R) does repairs for

- (i) B (to put boats into saleable condition) and
- (ii) other customers.

The following situation arises :

S can sell to a customer for Rs. 35,000 a new boat which would cost Rs. 29,000. To do so, it needs to offer Rs. 16,000 in part-exchange for the customer's old boat. However, the customer's boat is estimated by R to need repairs that will cost :

Materials	Rs. 300
Labour	60 hours at Rs. 15 per hour

B can buy for Rs. 15,000 a boat comparable to the one being offered by the customer in part-exchange but which needs no repair. B could then sell that boat for Rs. 19,000.

Other data :

- R's labour rate per hour is made up as follows :

Variable cost	Rs. 6.00	
Fixed cost	4.50	(based on 20,000 budgeted hours p.a.)
Profit	<u>4.50</u>	
	<u>15.00</u>	

- 45% of R's time is reserved for work from B
- Annual fixed cost is budgeted at :
 - S Rs. 70,000
 - B Rs. 80,000

You are required, in relation to the above situation, to set out the contribution to profit for each profit centre that would result,

- (i) assuming that all estimates and budgets materialised as expected,

- (ii) assuming that all estimates and budgets materialised as in (i), except that the repairs undertaken by R took an extra 10 hours and Rs. 100 of materials due to a problem not noticed by B or R.

Solution (a) (i) *Statement showing the contribution to profit for each profit centre assuming that all estimates and budgets materialised as expected.*

Sales Centre (S)	Rs.	Rs.	Rs.
New Boat Sold—Selling Price			35,000
—Purchase Price			<u>29,000</u>
Gross Margin			6,000
<i>Less : Second Hand Boat</i>			
Part-exchange of old boat		16,000	
Broker's Price	15,000		
<i>Less : Repairs</i>	<u>1,200</u>	(13,800)	<u>2,200</u>
Contribution			<u><u>3,800</u></u>
Brokerage Centre (B)			
Second-hand boat sold			19,000
<i>Less : Paid to centre S</i>		13,800	
Paid to Centre R		<u>1,200</u>	<u>15,000</u>
Contribution			<u><u>4,000</u></u>
Repair Centre (R)			
Sales to B			1,200
<i>Less : Materials</i>		300	
D.L. Variable cost		<u>360</u>	<u>660</u>
Contribution			<u><u>540</u></u>

(ii) Assuming Additional Costs

It is noticed that all estimates and budgets are materialised except that repairs undertaken by R took an extra 10 hours and Rs. 100 of materials due to a problem not noticed by B or R.

R is responsible for giving correct repair costs and, therefore, he has to bear the additional cost :

Repair Centre (R)'s contribution		Rs. 540
<i>Less : Extra cost of materials</i>	Rs. 100	
Extra D.L. Variable cost (10 hrs × Rs. 6)	<u>60</u>	<u>160</u>
Revised contribution		<u><u>380</u></u>

However, full details are not given in the question. 'B' is a middleman passing on R's costs to S and as such should not bear additional costs. Had the item been noticed originally then S would have paid the cost and perhaps it should be passed back. This would be particularly so if R had insufficient opportunity for a complete inspection. In that case extra cost should be;

Material	Rs. 100
Labour (10 hrs × Rs. 15)	<u>150</u>
	250

Reduced contribution of S =	Rs. 3,800 – 250 = Rs. 3,550
Original contribution of R	Rs. 540
Add : Saving in variable cost [10 hrs × (Rs. 15–Rs.6)]	<u>90</u>
Increased contribution of R	<u>630</u>

Note : Other solutions are equally acceptable if well argued and logically justified

Problem 100 (Profitability of two machines—DCF Approach). EG Ltd has two machines used on a contract for a large customer, LC Ltd. Each machine can produce the same product and has a capacity of 40,000 units per year, but each has different characteristics resulting in the following total annual costs at different production levels which must be in lots of 10,000 units :

Annual production level Units	Annual total costs (Rs. '000)	
	Machine X	Machine Y
Nil	52*	65*
10,000	105	108
20,000	132	122
30,000	148	131
40,000	174	204

*This figure includes :

Direct materials

Direct labour } usable in other sections of the company if the machine
Direct expenses } were disposed of

Depreciation Rs. 8,000 p.a.

Apportioned production overhead Rs. 12,000 p.a.

The contract price to LC Ltd is Rs. 6.00 per unit. The company's cost of capital is 13%.

FG Ltd expects that sales will end in five years' time and that the quantities required by LC Ltd will average 75% of its present total capacity.

FG Ltd has received an invitation to sell either of the machines to an overseas organisation and must decide whether it should do so and, if so, at what price. If it retains either or both machines, each is expected to have a scrap value of Rs. 20,000 in five years' time. If one of the machines is sold to the overseas organisation, FG Ltd will not have to pay any penalty to LC Ltd on account of any shortfall in delivery.

You are required :

- to set out a table from 10,000 to 40,000 units to show which machine or combination of machines should be used at each level to yield minimum costs to FG Ltd;

(b) to recommend to FG Ltd;

(i) which level of total unit sales will yield the largest profit,

(ii) which machine it should offer to the overseas company and the minimum price at which it should offer that machine (to the nearest Rs. 1,000 upwards);

Show your supporting calculations.

Ignore taxation.

Solution

Incremental operating costs		(Rs. '000)
Output (<i>'000 units</i>)	Machine X	Machine Y
10	53	43
20	80	57
30	96	66
40	122	139

(a) Minimum cost table

Machine X		Machine Y		(Rs. '000)
Output (<i>'000 units</i>)	Output	Cost	Output	Cost
10	—	—	10	43
20	—	—	20	57
30	—	—	30	66
40	10	53	30	66
50	20	80	30	66
60	30	96	30	66
70	40	122	30	66
80	40	122	40	139
				Total Cost
				43
				57
				66
				119
				146
				162
				188
				261

(b) (i) Profitability

Output (<i>'000 units</i>)	Sales @ Rs. 6 per unit	Cost	(Rs. '000) Contribution
10	60	43	17
20	120	57	63
30	180	66	114
40	240	119	121
50	300	146	154
60	360	162	198
70	420	188	232
80	480	261	219

The level of activity which yields the largest profit is 70,000 units

(ii) Full capacity—40,000 units produced on each machine

	Machine X	Machine Y
Sales Value	240	240
Costs	<u>174</u>	<u>204</u>
Profit	<u>66</u>	<u>36</u>

As machine Y yields lower profit, the same should be offered for sale.

		Financial Effect (Rs. '000)	
Output→		With two machines (60,000 units)	With Machine X only (40,000 units)
Sales		360	240
Costs X	30,000 units	(148)	X 40,000 (174)
Y	30,000 units	<u>(131)</u>	Y — <u>(12)</u>
Profit		81	54
Annual loss		/-----\	
		27	

Cash flow					
<i>Year</i>	<i>Loss of profit</i> (Rs. '000)	<i>Loss of residual value</i> (Rs. '000)	<i>Net cash flow</i> (Rs. '000)	<i>DCF factor</i> 13%	<i>Discounted net cash flow</i> (Rs. '000)
1	(27)		(27)	2.97	(80.19)
2	(27)		(27)		
3	(27)		(27)		
4	(27)		(27)		
5	(27)	(26)	(47)	0.54	<u>(25.38)</u> <u>(105.57)</u>

The Minimum selling price for machine Y should be Rs. 1,06,000.

Problem 101 (Profitability of Purchasing and stock holding).

A company buys and sells a product whose demand over the past few years has fluctuated between 8,000 and 17,000 units per month. Its selling price is Rs. 60 per unit. Data for last year were :

<i>Month</i>	<i>Orders received</i> (000 units)	<i>Purchases</i> (000 units)
1	16	11
2	14	10
3	14	16
4	13	14
5	10	12
6	15	12
7	10	14
8	9	16
9	17	17
10	12	16
11	10	12
12	12	15

At the beginning of month 1 there was a stock of 1,000 units and there were no unfilled orders to customers.

Arrangements with the supplier are that :

- there is a standing order of 12,000 units per month at a price of Rs. 35 per unit.
- if more are needed in any month the price of the extra items is Rs. 40 per unit.
- if fewer are needed in any month, the quantity ordered can be reduced in lots of 1,000 units at a 'penalty' of Rs. 9 per unit.
- for any change from the standing order, two months' notice must be given (such that a request for a change in month 3 must be notified in month 1, and so on).

Other data :

- The cost of stockholding is Rs. 3 per unit per month based on and charged in the month of sale.
- If the company is out of stock, it must reduce the price to the customer by 10% of the selling price for each month of delivery delay.
- Stock carried forward is valued at Rs. 35 per unit.
- Fixed cost is Rs. 1,00,000 per month.

You are required to

- calculate the net profit for the company for the past year;
- recommend, from your answer and the data available, what general rules should be adopted in respect of planning for monthly purchases and general stock-holding, assuming that you wish to maximise profit.

Solution. (a) Workings

Purchases, stocks and sales analysis

('000 units)

Month	Opening stock	Purchases	Stock available	Opening unfilled orders	Orders received	Total orders	Sales	Unfilled orders	Closing stock
1	1	11	12	—	16	16	12	4	—
2	—	10	10	4*	14	18	10	8	—
3	—	16	16	8	14	22	16	6	—
4	—	14	14	6	13	19	14	5	—
5	—	12	12	5	10	15	12	3	—
6	—	12	12	3	15	18	12	6	—
7	—	14	14	6	10	16	14	2	—
8	—	16	16	2	9	11	11	—	5
9	5@	17	22	—	17	17	17	—	5
10	5	16	21	—	12	12	12	—	9
11	9	12	21	—	10	10	10	—	11
12	11	15	26	—	12	12	12	—	14
	31	165					152	34	

* Representing unfilled orders of the previous month

@ Closing stock of previous month

Sales : Up to month 7 figures in total orders column are more than stock available and as such all available stocks are completely sold out. However from month 8, onwards total orders figures are less than the available stock and as such sales will be equal to total orders.

Profit statement for the year

	(Rs. '000) (Rs. '000)	
Sales 1,52,000 units at Rs. 60 per unit	9,120	
Less : Penalty for unfilled order		
34,000 units at Rs. 6 each (10% of Rs. 60)	<u>204</u>	8,916
Purchases 1,65,000 units at Rs. 35 each	5,775	
Add : Penalty for orders under 12,000 units		
3,000 units at Rs. 9 each (Purchases lower than 12,000 units for month 1 and 2)	27	
Add : Penalty for orders over 12,000 units		
24,000 units at Rs. 5 each	<u>120</u>	147
Add : Stockholding costs		
31,000 units at Rs. 3 each	<u>93</u>	
	6,015	
Less : Stock increase in the year		
*13,000 units at Rs. 35 each	<u>455</u>	<u>5,560</u>
Contribution		3,356
Fixed costs		<u>1,200</u>
Profit		<u>2,156</u>

* Total of purchases less total sales.

(b) General planning rules

1. It is better to overstock at a cost of Rs. 3 per unit per month than to have unfilled orders at Rs. 6 per unit, therefore maintain stocks at 2,000 units minimum.
2. It is better to hold an extra unit in stock at Rs. 3 per unit per month than reduce the next month's order below 12,000 units at a penalty of Rs. 9 per unit. Therefore, let stock rise rather than reduce orders below 12,000 units
3. When orders are unfilled, order 12,000 units *plus* the unfilled quantity.
4. Try to keep stock levels after each delivery at 14,000 units.

C.A. Inter November 1989

Problem 102 (Break-even Analysis). The Laila Shoe Company sells five different styles of ladies' chappals with identical purchase costs and selling prices. The company is trying to find out the profitability of opening another store, which will have the following expenses and revenues :

	Rs. Per Pair
Selling Price	<u>30.00</u>
Variable Cost	19.50
Salesmen's Commission	<u>1.50</u>
Total Variable Cost	<u>21.00</u>

Annual fixed expenses are :—

Rent	Rs. 60,000
Salaries	2,00,000
Advertising	80,000
Other Fixed Expenses	20,000
	<u>3,60,000</u>

Required :—

- Calculate the annual break-even point in units and in value. Also determine the profit or loss if 35,000 pairs of chappals are sold.
- The sales commissions are proposed to be discontinued, but instead a fixed amount of Rs. 90,000 is to be incurred in fixed salaries. A reduction in selling price of 5% is also proposed. What will be the break-even point in units ?
- It is proposed to pay the store manager 50 paise per pair as further commission. The selling price is also proposed to be increased by 5%. What would be the break-even point in units ?
- Refer to the original data. If the store manager were to be paid 30 paise commission on each pair of chappal sold in excess of the break-even point, what would be the store's net profit if 50,000 pairs were sold ?

Note : Consider each part of the question separately.

Solution (a)	Contribution per pair	Rs. 9	
	Fixed cost	Rs. 3,60,000	
	B.E. Sales Rs. $3,60,000 \div 9$	40,000	pairs
	B.E. Sales Value = $40,000 \times \text{Rs. } 30$	Rs. 12,00,000	
(b)	Revised selling Price	Rs. 28.50	
	Revised variable cost	<u>19.50</u>	
	Contribution per pair	9.00	
	Revised fixed cost	Rs. 4,50,000	
	B.E. Sales = $\text{Rs. } 4,50,000 \div 9$	= 50,000	pairs
(c)	Revised selling price	Rs. 31.50	
	Revised variable cost	<u>21.50</u>	
	Contribution per pair	10.00	
	B.E. Sales = $\text{Rs. } 3,60,000 \div 10$	= 36,000	pairs
(d)	Original contribution per pair	Rs. 9	
	Total contribution on 50,000 pairs	Rs. 4,50,000	
	Less : Additional commission	<u>3,000</u>	
		4,47,000	
	Fixed Cost	<u>3,60,000</u>	
	Net Profit	<u>87,000</u>	

Problem 103 (Cost Sheet). A factory uses a job costing system. The following cost data are available from the books for the year ended 31st March, 1989:—

Direct Material	Rs. 9,00,000
Direct Wages	7,50,000

Profit	6,09,000
Selling and Distribution Overhead	5,25,000
Administration Overhead	4,20,000
Factory Overhead	4,50,000

Required :—

- Prepare a Cost Sheet indicating the Prime Cost, Works Cost, Production Cost, Cost of Sales and Sales Value.
- In 1989-90, the factory has received an order for a number of jobs. It is estimated that the direct materials would be Rs. 12,00,000 and direct labour would cost Rs. 7,50,000. What would be the price for these jobs if the factory intends to earn the same rate of profit on sales, assuming that the selling and distribution overhead has gone up by 15%. The factory recovers factory overhead as a percentage of direct wages and administration and selling and distribution overheads as a percentage of works cost, based on the cost rates prevalent in the previous year.

Solution (a) Cost Sheet for the year ending on 31-3-89

Direct material	Rs. 9,00,000
Direct wages	<u>7,50,000</u>
Prime Cost	16,50,000
Factory overhead (60% on direct wages)	<u>4,50,000</u>
Works cost	21,00,000
Administration overhead (20% on Works cost)	<u>4,20,000</u>
Cost of production	25,20,000
Selling and distribution overhead (25% on works cost)	<u>5,25,000</u>
Cost of sales	30,45,000
Profit (16.67% on sales or 20% on cost of sales)	<u>6,09,000</u>
Sales Value	<u><u>36,54,000</u></u>

COST SHEET

(b) **For the Job carried in 1989-90**

Direct material	Rs. 12,00,000
Direct labour cost	<u>7,50,000</u>
Prime Cost	19,50,000
Factory Overhead (60% on D.W.)	<u>4,50,000</u>
Works Cost	24,00,000
Admn. Overhead (20% on works cost)	<u>4,80,000</u>
Cost of production	28,80,000
Selling and distribution overhead (25% on works cost + 15% of Rs. 6,00,000)	<u>6,90,000</u>
Cost of sales	35,70,000
Profit 20% on cost of sales	<u>7,14,000</u>
Sales Value	<u><u>42,84,000</u></u>

Problem 104. (Variance Analysis). (a) Distinguish between standard costing and budgetary control (b) Following information is available from the records of a factory :—

Raw Material	Usage per unit of product (Kgs)	Re-order Quantity (Kgs)	Price per Kg	Delivery period (in weeks)			Re-order level (Kgs)	Minimum level (Kgs)
				Minimum	Average	Maximum		
A	10	10,000	0.10	1	2	3	8,000	
B	4	5,000	0.30	3	4	5	4,750	
C	6	10,000	0.15	2	3	4		2,000

Weekly production varies from 175 to 225 units, averaging 200 units of the said product. What would be the following quantities :—

- (i) Minimum Stock of A ? (ii) Maximum Stock of B ?
 (iii) Re-order level of C ? (iv) Average stock level of A ?

Solution. (a) Please refer to "Advanced Cost and Management Accounting—Text" by V.K. Saxena and C.D. Vashist.

(b) (i) Minimum stock level of A

$$= \text{Reorder Level} - (\text{Normal usage} \times \text{Avg. Delivery Time})$$

$$= 8,000 \text{ kgs} - \{ (200 \text{ units} \times 10 \text{ kg}) \times 2 \text{ weeks} \} = 4,000 \text{ kgs}$$

(ii) Maximum stock of B

$$= \text{Reorder Level} + \text{Reorder Quantity} - \text{Minimum consumption to obtain delivery}$$

$$= 4,750 \text{ kgs} + 5,000 \text{ kgs} - (175 \text{ units} \times 4 \text{ kgs} \times 3 \text{ weeks}) = 7,650 \text{ kgs.}$$

(iii) Reorder Level of C

$$\text{Maximum reorder period} \times \text{Max. usage}$$

$$= 4 \text{ weeks} \times (225 \text{ units} \times 6 \text{ kgs}) = 5400 \text{ kgs.}$$

OR

$$= \text{Min. stock} + (\text{Avg. rate of consumption} \times \text{Avg. Delivery Period})$$

$$= 2,000 \text{ kgs} + \{ (200 \times 6) \times 3 \text{ weeks} \} = 5,600 \text{ kgs.}$$

(iv) Average stock level of A

$$\text{Minimum level} + 1/2 \text{ Reorder Quantity}$$

$$4,000 \text{ kgs} + 1/2 \times 10,000 = 9,000 \text{ kgs.}$$

OR

$$(\text{Minimum stock} + \text{Maximum stock}) + 2$$

$$(4,000 + 16,250) + 2 = 10,125 \text{ kgs.}$$

$$(\text{Reorder Level} + \text{Reorder Quantity}) - (\text{Min. consumption} \times \text{Minimum Reorder Period}).$$

$$8,000 + 10,000 \text{ kg} - \{ (175 \times 10 \times 1) \} = 16,250 \text{ kgs.}$$

Problem 106. (Under-absorption of Overhead).

(a) What do you mean by the term under/over absorption of production overhead? How does it arise? How is it treated in cost accounts?

(b) In a factory, overheads of a particular department are recovered on the basis of Rs. 5 per machine hour. The total expenses incurred and the actual

machine hours for the department for the month of August were Rs. 80,000, and 10,000 hours respectively. Of the amount of Rs. 80,000, Rs. 15,000 became payable due to an award of the Labour Court and Rs. 5,000 was in respect of expenses of the previous year booked in the current months (August). Actual production was 40,000 units, of which 30,000 units were sold. On analysing the reasons, it was found that 60% of the under-absorbed overhead was due to defective planning and the rest was attributed to normal cost increase. How would you treat the under-absorbed overhead in the cost accounts ?

Solution (a) Please refer to "Advanced Cost and Management Accounting—Text" by V.K. Saxena and C.D. Vashist.

(b) Under-Absorbed Overheads during the month of August

Total expenses incurred		Rs. 80,000
Less : Award of the labour court	15,000	
Previous years' expenses	5,000	<u>20,000</u>
Net expenses incurred for the month		60,000
Overhead recovered (10,000 × 5)		<u>50,000</u>
Under-absorbed overhead		<u>10,000</u>

Treatment

Debit P & L A/c	Rs. 6,000
(Being 60% under-absorbed overhead due to defective planning)	
Debit Finished Goods	Rs. 1,000@
Debit Cost of Sales	3,000@
(Being 40% due to normal cost increase)	

@ Under absorbed overhead		Rs. 4,000	
Production		40,000	units
Recovery rate		Rs. 0.10	per unit
Amount charged to unsold production	10,000 × 0.10	Rs. 1,000	
Amount charged to Cost of Sales	30,000 × 0.10	Rs. 3,000	

C.A. Final November 1989

Problem 107 (Make or Buy Decision). (a) What factors have to be taken into account in a make or buy decision ?

(b) *SV Ltd.*, has budgeted the manufacture of 30,000 units of its only product 'A' for the next quarter. The capacity of the factory has not been fully utilised.

The variable cost per unit of Product 'A' is as under :

Direct materials	Rs. 48-00
Direct wages (Rs. 4 per hour)	36-80
Factory variable overheads	27-60
Selling overheads—variable	18-00

Production 'A' sold at Rs. 200 per unit. Fixed overheads for the quarter Rs 15,00,000.

At present the company manufactures component 'P', one unit of which is used in each unit of product A. The cost of this component is already included in the cost structure of Product 'A' as aforesaid. Anyhow the cost per batch of 1,000 units of the component 'P' is separately supplied as under :

	Rs.
Direct materials	6,000
Direct wages	4,800
Factory variable overheads	3,600
Fixed overheads apportioned to the component	<u>3,600</u>
Total costs	<u>18,000</u>

It is proposed to utilise the spare capacity by manufacture of 1,500 units of Product 'B' for export. The details are as under :

Export Selling Price	Rs. 228 per unit
Direct Material Cost	Rs. 80 per unit
Direct Labour	16 hours per unit
Variable selling expense applicable to this product is	Rs. 20 per unit

Factory variable overheads have to be charged, calculated on the basis of Direct Labour Hour rate applicable to Product A.

It has to be noted that component *P* is not used in the manufacture of Product *B*.

You are required to :

- (i) present a statement showing the profit as originally envisaged in the Budget.
- (ii) state whether component *P* should be manufactured or bought from the market if this can be procured at a price of Rs. 16 per unit.

- (iii) Calculate the contribution on account of accepting the export order of Production 'B'.

Solution : (a) Please refer to "Advanced Cost and Management Accounting—Text" by V.K. Saxena and C.D. Vashist.

		<i>Rs. Per unit of Product 'A'</i>	
(b) (i)	Selling Price	<u>200.00</u>	
	Direct materials	48.00	
	Direct Wages 9.2 hrs. @ Rs. 4 per hour	36.80	
	Factory variable overheads (9.2 × Rs. 3)	27.60	
	Selling variable overheads	<u>18.00</u>	
	Total variable overheads	<u>130.40</u>	
	Contribution per unit	Rs. <u>69.60</u>	
	Budgeted Production	<u>30,000</u>	units
	Total contribution (30,000 × 69.60)	Rs. 20,88,000	
	Fixed overheads	15,00,000	
	Profit	<u>5,88,000</u>	

		<i>Rs. per unit</i>	
(ii)	Cost to make component P		
	Direct materials	6.00	
	Direct wages	4.80	
	Factory variable overheads	<u>3.60</u>	
	Variable cost to make	<u>14.40</u>	
	Purchase cost	<u>16.00</u>	
	Saving if component is made	1.60	

Total saving (30,000 × 1.60) = Rs. 48,000. As plant is under-utilized, opportunity cost is zero. SV Ltd. should make the component 'P'.

- (iii) Statement showing the contribution on accepting the export order of Product 'B'.

		<i>Rs. per unit</i>	
	Selling Price	<u>228.00</u>	
	Direct materials	80.00	
	Direct wages (16 hrs × Rs. 4)	64.00	
	Variable factory overheads (16 × Rs. 3)	48.00	
	Variable selling overheads	<u>20.00</u>	
	Total variable cost	<u>212.00</u>	
	Contribution per unit	<u>16.00</u>	
	Total contribution (1,500 × 16)	= Rs. <u>24,000</u>	

Problem 108 (Product Mix). V. Ltd produces two products 'P' and 'Q'. The draft budget for the next month is as under :

	<i>P</i>	<i>Q</i>
Budgeted production and sale (units)	40,000	80,000
Selling Price Rs./unit	25	50
Total Costs Rs./unit	20	40
Machine Hours/unit	2	1
Maximum sales potential (units)	60,000	1,00,000

The fixed expenses are estimated at Rs. 9,60,000 per month. The company absorbs fixed overheads on the basis of machine hours which are fully utilised by the budgeted production and cannot be further increased.

When the budget was discussed, the Managing Director stated that the product mix should be altered to yield optimum profit.

The Marketing Director suggested that he could introduce a new Product 'C', each unit of which will take 1.5 machine hours. However, a processing vat involving a capital outlay of Rs. 2,00,000 is to be installed for processing product 'C'. The additional fixed overheads relating to the processing vat was estimated at Rs. 60,000 per month. The variable cost of product C was estimated at Rs. 21 per unit.

Required :

- (i) Calculate the profit as per draft budget for the next month.
- (ii) Revise the product mix based on data given for 'P' and 'Q' to yield optimum profit.
- (iii) The company decides to discontinue either Product 'P' or 'Q' whichever is giving lower profit and proposes to substitute Product 'C' instead. Fix the selling price of Product 'C' in such a way as to yield 15% return on additional capital employed besides maintaining the same overall profit as envisaged in (ii) above.

Solution : (i) Profit as per draft budget for the next month

Production	P		Q	
	40,000		80,000	
	Per unit	Total	Per unit	Total
Sales	Rs. 25	Rs. 10,00,000	Rs. 50	Rs. 40,00,000
Total cost	<u>20</u>	<u>8,00,000</u>	<u>40</u>	<u>32,00,000</u>
Profit	<u>5</u>	<u>2,00,000</u>	<u>10</u>	<u>8,00,000</u>

Total Profit (Rs. 2,00,000 + Rs. 8,00,000) = Rs. 10,00,000

	Product P	Product Q
Machine hour	40,000 × 2 = 80,000	80,000 × 1 = 80,000
Total machine hours		1,60,000
Fixed overhead rate/hr.		9,60,000 ÷ 1,60,000 = Rs. 6
Fixed overhead per unit	2 hrs × Rs. 6 = Rs. 12	1 hr. × Rs. 6 = Rs. 6
Contribution per unit = (F.C. + Profit)	Rs. 17 + 5 = 17	Rs. 6 + 10 = Rs. 16
Contribution per machine hour	Rs. 17 ÷ 2 = Rs. 8.50	Rs. 16 ÷ 1 = Rs. 16

Production Q has the higher contribution than product P. Therefore, first of all maximum of P should be produced. Total machine hours available are 1,60,000.

Product-mix	Contribution	Machine Hours
1,00,000 units of Q @ Rs. 16	Rs. 16,00,000	1,00,000
30,000 units of P @ Rs. 17	<u>5,10,000</u>	<u>60,000</u>
Total contribution	21,10,000	1,60,000
Fixed cost	<u>9,60,000</u>	
Profit	<u>11,50,000</u>	

- (iii) Product P which gives the lower contribution should be discontinued in favour of product C.

Machine hours available	= 60,000	hrs.
Production of C (@ 1.5 machine hour)	40,000	units
Variable cost (40,000 × Rs. 21)	= Rs. 8,40,000	
Additional fixed overheads	<u>60,000</u>	
Total cost	9,00,000	
Return on additional Capital		
Rs. 2,00,000 × 15% p.a. for one month	2,500	
Existing contribution from P	<u>5,10,000</u>	
Total Sales Value	14,12,500	
S.P. per unit (Rs. 14,12,500 ÷ 40,000)	= <u>Rs. 35.31</u>	
or say	Rs. 35.30	

† Problem 109 (Key Factor). A company has prepared the following flexible budget for a period :

	Capacity		
	80%	100%	120%
	Rs.	Rs.	Rs.
Variable Costs :			
Direct Materials	5,00,000	6,25,000	7,50,000
Direct Wages	6,00,000	7,50,000	9,00,000
Factory Overheads	3,00,000	3,75,000	4,50,000
Selling Overheads	3,00,000	3,75,000	4,50,000
Total	<u>17,00,000</u>	<u>21,25,000</u>	<u>25,50,000</u>
Fixed Costs :			
Factory Overheads	8,00,000	8,00,000	15,00,000
Administration Overheads	3,00,000	3,00,000	4,00,000
Selling Overheads	2,00,000	2,00,000	6,00,000
Total	<u>13,00,000</u>	<u>13,00,000</u>	<u>25,00,000</u>
Grand Total	<u>30,00,000</u>	<u>34,25,000</u>	<u>50,50,000</u>

The total direct labour at 100% capacity is 3,00,000. The company's policy is to add a mark-up of 20% on variable costs for profit. During the period, the company intends to produce Product 'A'. The unit variable cost data relating to Product 'A' are as under :

Direct Materials	Rs. 30	Direct Wages	Rs. 60
Factory Overheads	Rs. 30	Selling Overheads	Rs. 30
Direct hours per unit 8.			

You are required to calculate for Product 'A' the selling price to be charged at each level of capacity if :

- there is no limiting factor
- direct material is in short supply
- direct labour hour is in short supply.

Solution : Direct wages at 100% Capacity = Rs. 7,50,000

Direct labour hours at 100% capacity = 3,00,000

Rate per labour hour = Rs. 2.50

However, rate per labour hour for Product A = Rs. 60 ÷ 8 = Rs. 7.50

Therefore, it is clear that grade of labour required for product A is quite different from the grade of labour given in the flexible budget.

(a) **Selling price of Product 'A' at different capacity levels when there is no limiting factor**

	<u>Capacity</u>		
	80%	100%	120%
1. Total fixed cost (Rs.)	13,00,000	13,00,000	25,00,000
2. Direct labour hours	2,40,000*	3,00,000	3,60,000*
3. F.O. rate per labour hour (1+2) (Rs.)	5.417	4.333	6.944
4. D.L.H. per unit of Product A	8	8	8
5. F.O. per unit of Product A (3 × 4)	Rs. 43.34	34.66	55.55
6. Variable cost per unit of Product A (Rs. 30 + 60 + 30 + 30)	Rs. 150.00	150.00	150.00
7. Mark-up (20% of variable cost)	<u>30.00</u>	<u>30.00</u>	<u>30.00</u>
8. Selling price (5 + 6 + 7)	Rs. <u>223.34</u>	<u>214.66</u>	<u>235.55</u>

(b) **Selling price of 'A' at different capacity utilization when direct material in short supply**

	<u>Capacity</u>		
	80%	100%	120%
1. Direct material as per flexible budget (Rs.)	5,00,000	6,25,000	7,50,000
2. Direct material cost per unit of product 'A' (Rs.)	30.00	30.00	30.00
3. Total production (units) 1 + 2	16,667	20,833	25,000
4. Total variable cost @ Rs. 150 per unit (Rs.) (rounded off)	25,00,000	31,25,000	37,50,000
5. Desired profit (20% of 4)	5,00,000	6,25,000	7,50,000
6. Fixed cost	<u>13,00,000</u>	<u>13,00,000</u>	<u>25,00,000</u>
7. Contribution (5 + 6)	<u>18,00,000</u>	<u>19,25,000</u>	<u>32,50,000</u>
8. Contribution per unit (7 ÷ 3) Rs.	108.00	92.40	130.00
9. Variable cost per unit	<u>150.00</u>	<u>150.00</u>	<u>150.00</u>
10. Selling price per unit	<u>258.00</u>	<u>242.40</u>	<u>280.00</u>

* Strictly variable to capacity utilization. At 120% Capacity, there is substantial increase in fixed cost.

**(c) Selling Price of Product A at different capacity utilization
when direct labour is in short supply.**

	<i>Capacity</i>		
	<i>80%</i>	<i>100%</i>	<i>120%</i>
1. Direct labour hours	2,40,000	3,00,000	3,60,000
2. D.L.H. per unit (Rs.)	8	8	8
3. Production units (1 ÷ 2)	30,000	37,500	45,000
4. Total variable cost @ Rs. 150 per unit (Rs.)	45,00,000	56,25,000	67,50,000
5. Desired profit (20% of 4)	9,00,000	11,25,000	13,50,000
6. Fixed cost	<u>13,00,000</u>	<u>13,00,000</u>	<u>25,00,000</u>
7. Desired contribution	22,00,000	24,25,000	38,50,000
8. Contribution per unit	73.33	64.67	85.56
9. Variable cost per unit	<u>150.00</u>	<u>150.00</u>	<u>150.00</u>
	<u>223.33</u>	<u>214.67</u>	<u>235.56</u>

Problem 110 (Semi-Automatic Machine vs. Automatic Machine). A company proposes to install a machine for the manufacture of a component which at present is being purchased at Rs. 24 each. There are two alternatives, namely (a) installation of an automatic machine and (b) installation of a semi-automatic machine. The details of the two machines are as under :

	<i>Automatic Machine</i>	<i>Semi-Automatic Machine</i>
Initial cost of machine (Rs.)	9,00,000	6,00,000
Life	10 years	10 years
Fixed overheads other than depreciation on machines (per annum) (Rs.)	1,62,000	84,000
Variable expenses of the component (Rs.)	12	15

The company charges depreciation on straight line method. Scrap value of the machine at the end of life is nil.

The demand for the components at present is 20,000 units per annum. This demand is expected to increase to 40,000 units.

Required :

- For each of the two volumes of output namely 20,000 and 40,000 units, state with supporting calculations whether the components should be purchased or manufactured by installation of machine. If your decision is in favour of installation of machine, which model will you advise ?
- At what volume of output should the company change over from purchase of components to manufacture by installation of (i) semi-automatic machine and (ii) automatic machine.
- At what volume of manufacture of the components will the company switch over from installation of one type of machine to the other ?

Solution : (a) Statement showing the cost per unit under various alternatives.

	20,000 units		40,000 units	
	Automatic Machine	Semi-Automatic Machine	Automatic Machine	Semi-Automatic Machine
Variable cost	12.00	15.00	12.00	15.00
Fixed overheads other than depreciation	8.10*	4.20*	4.05*	2.10*
Depreciation	4.50@	3.00@	2.25@	1.50@
Total cost of manufacture	24.60	22.20	18.30	18.60
Cost of buying per unit	24.00	24.00	24.00	24.00

It is profitable to install semi-automatic machine at the production level of 20,000 units. However at the volume of 40,000 units, automatic machine should be installed.

(b) Change over from purchase to manufacture.

	Automatic Machine	Semi-Automatic Machine
1. Purchase price of component	Rs. 24.00	Rs. 24.00
2. Variable costs of manufacture	<u>12.00</u>	<u>15.00</u>
3. Saving	<u>12.00</u>	<u>9.00</u>
4. Total fixed cost as per footnote	Rs. 2,52,000	Rs. 1,44,000
5. Number of units at which change over is effected (4 + 3)	21,000 units	16,000 units

(c) Switchover from one type of machine to the other

	Automatic Machine	Semi-Automatic Machine	Difference
1. Variable cost	Rs. 12	Rs. 15	Rs. 3
2. Total fixed cost	Rs. 2,52,000	Rs. 1,44,000	Rs. 1,08,000
3. Number of units at which switch over is effected (Differential cost 2 + 1)		36,000 units	

* F.O per unit $1,62,000 \div 20,000$ $84,000 \div 20,000$ $1,62,000 \div 40,000$ $84,000 \div 40,000$
 @ Depreciation per unit Rs. $90,000 \div 20,000$ $60,000 \div 20,000$ $20,000 \div 40,000$ $60,000 \div 40,000$
 Total fixed cost Rs. 2,52,000 1,44,000 2,52,000 1,44,000

Problem 111 (Standard Costing—Reconciliation)

Standard cost card of a product is as under :

<i>Direct Materials :</i>	<i>Rs.</i>
A. 2 kg. @ Rs. 3 per kg.	6.00
B. 1 kg. @ Rs. 4 per kg.	4.00
Direct wages 5 Hours @ Rs. 4 per hour	20.00
Variable overheads 5 Hours @ Re. 1 per hour	5.00
Fixed overheads 5 Hours @ Rs. 2 per hour	<u>10.00</u>
Total	45.00
Standard profit	<u>5.00</u>
Standard Selling Price	<u>50.00</u>

Budgeted output is 8,000 units per month.

In October 1989, the company produced and sold 6,000 units. The actual sales value was Rs. 3,05,000. Direct material consumed was : Material A 14,850 kg valued at Rs. 43,065 and material B 7,260 kg valued at Rs. 29,750. The total direct labour hours worked was 32,000 and the wages paid therefor amounted to Rs. 1,27,500. The direct labour hours actually booked on production was 31,800. Overheads recorded were : Fixed Rs. 80,600 and variable Rs. 30,000. Closing work in progress was 600 units in respect of which materials A and B were fully issued and labour and overheads were 50% complete.

Analyse the variances and present an operating statement showing the reconciliation between budgeted and actual profit for the month in the following format :

Operating Statement	<i>Rs.</i>
<i>Budgeted Profit</i>	
<i>Sales Variances</i>	
<i>Price</i>	
<i>Volume</i>	
<i>Total</i>	
<i>Cost variances</i>	
<i>Direct Materials</i>	
<i>Price</i>	
<i>Yield</i>	
<i>Mix</i>	
<i>Direct Wages</i>	
<i>Rate</i>	
<i>Efficiency</i>	
<i>Idle Time</i>	
<i>Variable Overheads</i>	
<i>Expenses</i>	
<i>Efficiency</i>	
<i>Fixed Overheads</i>	
<i>Expense</i>	
<i>Efficiency</i>	
<i>Idle Time</i>	
<i>Capacity</i>	
<i>Total Cost Variances</i>	
<i>Actual Profit</i>	

Solution : Working Notes .**Statement showing work done in terms of equivalent units.**

Details	Equivalent units					
	Materials		Labour		Overhead	
	Units	%	Units	%	Units	%
Units completed	6,000	100%	6,000	100%	6,000	100%
Closing stock	600	100%	300	50%	300	50%
	6,600		6,300		6,300	

For Material Cost Variance

M₁— Actual Cost of material used :

A -	14,850	kg -	Rs. 43,065
B -	<u>7,260</u>	kg -	<u>29,750</u>
	22,110		72,815

M₂—Standard cost of material used :

A -	14,850	kg ×	Rs. 3	=	Rs. 44,550	
B -	<u>7,260</u>	kg ×	Rs. 4	=	Rs. <u>29,040</u>	73,590
	22,110					

M₃—Standard cost of material if it had been used in standard proportion :

A -	(2/3) × 22,110 × Rs. 3	Rs. 44,220	
B -	(1/3) × 22,110 × Rs. 4	<u>29,480</u>	73,700

M₄— Standard cost of output 6,600 units × Rs. 10 Rs. 66,000

Material Price Variance = M₁ - M₂ = Rs. 72,815 - Rs. 73,590 = Rs. 775 (F)

Material Mix Variance = M₂ - M₃ = Rs. 73,590 - Rs. 73,700 = Rs. 110 (F)

Material Yield Variance = M₃ - M₄ = Rs. 73,700 - Rs. 66,000 = Rs. 7,700 (A)

For Labour Cost Variances

L₁ — Actual payment made to workers for actual hours worked
(for 32,000 hours)

Rs. 1,27,500

L₂ — Payment involved, if the worker had been paid at standard
rate 32,000 hours × Rs. 4.00

Rs. 1,28,000

L₃ — There is no gang variance

Nil

L₄ — Standard labour cost of labour hours utilized

31,800 hours × Rs. 4.00

Rs. 1,27,200

L₅ — Standard labour cost of output achieved

6,300 units × Rs. 20

Rs. 1,26,000

Wage Rate Variance = L₁ - L₂ = Rs. 1,27,500 - Rs. 1,28,000 = Rs. 500 (F)

Wage Idle Time Variance - L₃ - L₄ = Rs. 1,28,000 - Rs. 1,27,200 = Rs. 800 (A)

Wage Yield Variance = L₄ - L₅ = Rs. 1,27,200 - Rs. 1,26,000 = Rs. 1,200 (A)

For Variable Overhead Variance

VO₁— Actual variable overhead Rs. 30,000

VO₂— Actual hours worked at standard variable O.H. rate
31,800 hrs × Rs. 1 Rs. 31,800

VO₃— Standard variable O.H. for the production
6,300 units × Rs. 5 Rs. 31,500

Variable O.H. Expenditure Variance = VO₁ – VO₂ = Rs. 30,000 – Rs. 31,800
= Rs. 1,800 (F)

Variable O.H. Efficiency Variance = VO₂ – VO₃ = Rs. 31,800 – Rs. 31,500
= Rs. 300 (A)

For Fixed O.H. Variance

FO₁— Actual F.O. incurred = Rs. 80,600

FO₂— Budgeted F.O. for the period (8,000 units × Rs. 10) = 80,000

FO₃— F.O. for days/hours available at standard rate
32,000 hours × Rs. 2.00 = Rs. 64,000

FO₄— F.O. for actual hours worked 31,800 hours × Rs. 2 = Rs. 63,600

FO₅— Standard fixed O.H. for production 6,300 units × Rs. 10 = Rs. 63,000

F.O. Expenditure Variance = FO₁ – FO₂ = Rs. 80,600 – Rs. 80,000
= Rs. 600 (A)

F.O. Idle Time Variance = FO₂ – FO₃ = Rs. 80,000 – Rs. 64,000
= Rs. 16,000 (A)

F.O. Capacity Variance = FO₃ – FO₄ = Rs. 64,000 – Rs. 63,600 = 400 (A)

F.O. Efficiency Variance = FO₄ – FO₅ = Rs. 63,600 – Rs. 63,000 = Rs. 600 (A)

Note : Instead of budgeted 40,000 hrs. only 32,000 hrs. were available. This gives rise to idle time variance. All 32,000 hrs. were not utilized and only 31,800 hrs. were (*i.e.*, capacity available) was not utilized. This gives rise to capacity variance.

For Sales Price Margin Variance

SM₁— Actual Sales Margin on actual sales, *i.e.*, Actual Sales –
Standard Cost of Actual Sales
Rs. 3,05,000 – (6,000 × Rs. 45) = Rs. 35,000

SM₂— Standard Sales Margin on actual sales.
6,000 × Rs. 5 = Rs. 30,000

SM₃— There is no Sales Margin Mix Variance. Nil

SM₄— Budgeted Sales Margin
8,000 × Rs. 5 = Rs. 40,000

Sales Margin Price Variance = SM₁ – SM₂ = Rs. 35,000 – Rs. 30,000
= Rs. 5,000 (F)

Sales Margin Volume Variance = $SM_2 - SM_4 = \text{Rs. } 30,000 - \text{Rs. } 40,000$
 = Rs. 10,000 (A)

Operating Statement

Budgeted Profit (8,000 units \times Rs. 5) Rs. 40,000

Sales Margin Variance

	(F)	(A)	
S.M. Price Variance	Rs. 5,000		
S.M. Volume Variance		Rs. 10,000	
Total			5,000 (A)

Cost Variances

Direct Materials

Price	775	7,700
Yield		
Mix	110	

Direct Wages

Rate	500	
Efficiency (yield)		1,200
Idle time		800

Variable O.H.

Expense	1,800	
Efficiency		300

Fixed O.H.

Expense		600
Efficiency		600
Idle time		16,000
Capacity		400

Total Cost variances	<u>3,185</u>	<u>27,600</u>	<u>24,415 (A)</u>
Actual Profit			<u>10,585</u>

I.C.W.A. Inter December 1989

Problem 112 (Valuation of Materials/Stock). A manufacturing organisation has imported four types of materials. The invoice reveals the following data.

Material	Quantity	Rate
	kgs	U.S. \$ per kg.
A	1,000	1.50
B	2,000	1.25
C	1,500	2.00
D	3,000	1.00
Import duty		23% of invoice value
Insurance		2% of invoice value
Freight and Clearing		Rs. 30,000
Exchange Rate U.S. \$ 1 = Rs. 16.00.		

50% of the materials imported are issued to production centres. While determining the value of closing stock 5% allowance is provided to cover up storage loss. Determine the value of closing stock of each type of materials.

Solution (a)**Statement of Material Cost**

<i>Materials</i>	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>Total</i>
Quantity Imported (kg)	1,000	2,000	1,500	3,000	7,500
Rate-US\$ per kg	<u>1.50</u>	<u>1.25</u>	<u>2.00</u>	<u>1.00</u>	<u>--</u>
Value (US\$)	1,500	2,500	3,000	3,000	—
Import Duty (23%)	345	575	690	690	
Insurance	<u>30</u>	<u>50</u>	<u>60</u>	<u>60</u>	<u>—</u>
Total Cost (US\$)	<u>1,875</u>	<u>3,125</u>	<u>3,750</u>	<u>3,750</u>	<u>12,500</u>
Total Cost (Rs.)	30,000	50,000	60,000	60,000	2,00,000
Freight and clearing charges*	<u>4,000</u>	<u>8,000</u>	<u>6,000</u>	<u>12,000</u>	<u>30,000</u>
Total Cost (Rs.)	34,000	58,000	66,000	72,000	2,30,000
Issued to production @ 50%	<u>17,000</u>	<u>29,000</u>	<u>33,000</u>	<u>36,000</u>	<u>1,15,000</u>
Balance Stock	17,000	29,000	33,000	36,000	1,15,000
Less 5% allowance for storage shortage	<u>850</u>	<u>1,450</u>	<u>1,650</u>	<u>1,800</u>	<u>5,750</u>
Value of stock	<u>16,150</u>	<u>27,550</u>	<u>31,350</u>	<u>34,200</u>	<u>1,09,250</u>

*Freight and clearing charges assumed to be based on weight.

Problem 113 (Remuneration and Incentives). From the following particulars you are required to work out the earnings of a worker for a week under (a) Straight piece-rate, (b) Differential piece-rate, (c) Halsey premium scheme (50% sharing), and (d) Rowan premium scheme.

Weekly working hours	48
Hourly wage rate	Rs. 7.50
Piece rate per unit	Rs. 3.00
Normal time taken per piece	20 minutes
Normal output per week	120 pieces
Actual output for the week	150 pieces
Differential piece-rate	80% of piece-rate when output below normal and 120% of piece-rate when output above normal.

Solution :

- (a) *Straight piece rate* = No. of units × piece rate per unit
 = 150 × Rs. 3.00 = Rs. 450
- (b) *Differential piece-rate* = 120% of piece rate when at or above standard as per Taylor's system.
 = 150 × 3 × 1.20 = Rs. 540
- (c) *Halsey Premium Scheme* = Hours worked × Rate per hour + 50% of time saved × Rate per hour
 = 48 hrs × 7.50 + { 50% of 10 hrs* × Rs. 7.50 }
 = Rs. 360 + Rs. 37.50 = Rs. 397.50

$$* \{ (150 \text{ pieces} - 120 \text{ pieces}) \times 20 \text{ minutes} \} \times \frac{1}{60} = 10 \text{ hrs.}$$

$$\begin{aligned} (d) \text{ Rowan Premium System} &= \text{Hrs worked} \times \text{Time Rate} \\ &+ \left(\frac{\text{Time Saved}}{\text{Time Allowed}} \times \text{Time wages} \right) \\ &= 48 \text{ hrs} \times 7.50 + \left\{ \frac{10 \text{ hrs}}{50 \text{ hrs}} \times 48 \text{ hrs} \times 7.50 \right\} \\ &= \text{Rs. } 360 + 72 = \text{Rs. } 432 \end{aligned}$$

$$\text{Time Allowed} = (150 \text{ pieces} \times 20 \text{ minutes}) \times \frac{1}{60} = 50 \text{ hrs.}$$

The workings given above are based on the assumption that worker is assured of the wages of 48 hours per week although the work was done in 40 hours. There can be another approach to the question i.e., by taking time to be 48 hours and then earnings made under the two plans will be as follows :

$$\text{Halsey Premium Scheme} = 48 \times 7.50 + 50\% (50 - 48) \times \text{Rs. } 7.50 = \text{Rs. } 367.50$$

$$\text{Rowan Premium Scheme} = 48 \times 7.50 + \frac{50 - 48}{50} \times 48 \times 7.50 = \text{Rs. } 374.50$$

Problem 114 (Further Processing). (a) In a concern engaged in process industry four products emerge from a particular process of operation. The total cost of input for the period ended 30th September 1989 is Rs. 2,55,500. The details of output, additional a cost after "split-off point" and sales value of the products are appended below.

Products	Output Kgs.	Additional process cost after split-off point	Sales value
A	8,000	Rs. 60,000	Rs. 1,68,000
B	5,000	10,000	1,10,000
C	3,000	—	60,000
D	4,000	20,000	90,000

If the products are sold at "split-off point" without further processing, the sales value would have been :

A	Rs. 1,15,000
B	90,000
C	55,000
D	80,000

You are required to prepare a statement of profitability based on the products being sold

- after further processing ; and
 - at the split-off point
- (b) Name any four methods, which are used to divide semi-variable overheads into their fixed and variable overhead component.

Solution**(a)(i) Statement showing profitability after further processing**

<i>Products</i>	<i>Sales Value</i>	<i>Additional processing</i>	<i>Equivalent Sales value at split-off-point</i>	<i>Joint Cost</i>	<i>Profit</i>
	<i>Rs.</i>	<i>Rs.</i>	<i>Rs.</i>	<i>Rs.</i>	<i>Rs.</i>
A	1,68,000	60,000	1,08,000	81,000	27,000
B	1,10,000	10,000	1,00,000	75,000	25,000
C	60,000	—	60,000	45,000	15,000
D	<u>90,000</u>	<u>20,000</u>	<u>70,000</u>	<u>52,500</u>	<u>17,500</u>
	<u>4,28,000</u>	<u>90,000</u>	<u>3,38,000</u>	<u>2,53,500*</u>	<u>84,500</u>

* Joint cost has been apportioned on the basis of equivalent sales value at the split-off point.

(ii) Statement of profitability if sold at split-off point.

<i>Products</i>	<i>Sales Value</i>	<i>Joint Cost</i>	<i>Profit</i>
A	Rs. 1,15,000	Rs. 85,743	Rs. 29,257
B	90,000	67,103	22,897
C	55,000	41,007	13,993
D	<u>80,000</u>	<u>59,647</u>	<u>20,353</u>
	<u>3,40,000</u>	<u>2,53,500*</u>	<u>86,500</u>

* Joint Cost apportioned on the basis of sales value.

(b) Please refer to "Advanced Cost and Management Accounting—Text" by V.K. Saxena and C.D. Vashist.

Problem 115 (P/V Ratio). (a) XYZ Ltd is selling three brands of its products in the brand names X, Y, and Z. The details, regarding unit cost and selling prices are as under :

	<i>X</i>	<i>Y</i>	<i>Z</i>
Direct Materials	Rs. 6	Rs. 12	Rs. 16
Direct Labour	8	8	20
Variable Overhead	6	20	14
Selling Price	36	50	96

The monthly fixed expenditure is Rs. 5,40,000. Sales volume for the months of July and August of 1989 are as follows :

	<i>X</i>	<i>Y</i>	<i>Z</i>
July	20,000	20,000	20,000
August	40,000	26,000	10,000

Find out the monthly profits and if your computation brings out that higher profit was earned in the month having lower sales volumes, kindly justify the finding with reasons.

(b) Name any six methods of incentive payments to workers.

Solution : (a) Statement of Cost/Contribution per unit

	X	Y	Z
Direct Materials	Rs. 6	Rs. 12	Rs. 16
Direct Labour	8	8	20
Variable Overhead	<u>6</u>	<u>20</u>	<u>14</u>
Marginal Cost	<u>20</u>	<u>40</u>	<u>50</u>
Selling Price	<u>36</u>	<u>50</u>	<u>96</u>
Contribution	<u>16</u>	<u>10</u>	<u>46</u>

For July

	X	Y	Z	Total	
Sales (units)	20,000	20,000	20,000	60,000	units
Contribution (Rs.)	3,20,000	2,00,000	9,20,000	14,40,000	
Fixed Cost (Rs.)				<u>5,40,000</u>	
Profit (Rs.)				<u>9,00,000</u>	

For August

	X	Y	Z	Total	
Sales (Units)	<u>40,000</u>	<u>26,000</u>	<u>10,000</u>	76,000	units
Contribution (Rs.)	6,40,000	2,60,000	4,60,000	13,60,000	
Fixed Cost				<u>5,40,000</u>	
Profit (Rs.)				<u>8,20,000</u>	

Comments—Physical sales in units have gone up from 60,000 units in July to 76,000 units in August. Still profit has come down from Rs. 9,00,000 in July to Rs. 8,20,000 in August. This is due to change in composition of sales. Z is making a contribution of Rs. 46 per unit. Its sale has gone down from 20,000 units in July to 10,000 units in August. The increase in physical sales of X and Y could not compensate for loss of sales of Z, which was making highest contribution per unit.

(b) Please refer to "Advanced Cost and Management Accounting—Text" by V. K. Saxena and C. D. Vashist.

Problem 116 (Absorption Costing vs. Marginal Costing). (a) The data below relates to a company which makes and sells computers.

	March	April
Sales	5,000 units	10,000 units
Production	10,000 "	5,000 "
Selling Price/unit	Rs. 100	Rs. 100
Variable Production cost/unit	Rs. 50	50
Fixed Production overhead incurred	1,00,000	1,00,000
Fixed Production overhead cost per unit, being the predetermined overhead absorption rate.	10	10
Selling Distribution and administration cost (all fixed)	50,000	50,000

You are required to present comparative profit statement for each month using

- (i) absorption costing
- (ii) marginal costing.

(b) Comment on the following statement using the figures contained in your answer to (a). "Marginal costing rewards sales whereas absorption costing rewards production."

Solution :

(a) (i) Profit statement using absorption costing

(Rs. in thousands)

	March		April	
1. Sales (5,000 units × Rs. 100) (10,000 units × Rs. 100)		500		1,000
2. Cost of Goods Sold :				
Op/Stock	—		300	
Variable cost of production (10,000 × Rs. 50) (5,000 × Rs. 50)	500		250	
Fixed Production overhead (10,000 × Rs. 10) (5,000 × Rs. 10)	100		50	
Under-absorbed overhead			50	
	600		650	
Less Closing stock (5,000 × Rs. 60)	300		—	
Cost of goods sold		300		650
Gross Profit		200		350
Less Selling and Admini- stration Cost		50		50
Profit		150		300

(ii) Profit statement under Marginal Costing

(Rs. in thousands)

	March		April	
1. Sales (5,000 × Rs. 100) (10,000 × Rs. 100)		500		1,000
2. Cost of Goods sold :				
Op/Stock	—		250	
Production (10,000 × Rs. 50) (5,000 × Rs. 50)	500		250	
	500		500	
Less Closing stock (5,000 × Rs. 50)	250		—	
Cost of Goods sold		250		500
Contribution		250		500
Less Fixed Cost :				
Production O.H.		100		100
Selling and Admn. O.H.		50		50
Net Profit		100		350

(b) Please refer to "Advanced Cost and Management Accounting—Text" by V. K Saxena and C. D. Vashist.

Problem 117 (Flexible Budget). ABC Ltd. manufactures a single product for which market demand exists for additional quantity. Present sale of Rs. 60,000 per month utilises only 60% capacity of the plant. Sales Manager assures that with a reduction of 10% in the price he would be in a position to increase the sale by about 25% to 30%.

The following data are available :

- | | |
|------------------------|-----------------------------------------------------------------------|
| (a) Selling price | Rs. 10 per unit. |
| (b) Variable Cost | Rs. 3 per unit. |
| (c) Semi-variable Cost | Rs. 6,000 fixed plus Rs. 0.50 per unit. |
| (d) Fixed Cost | Rs. 20,000 at present level estimated to be Rs. 24,000 at 80% output. |

You are required to submit the following statements to the board showing :

(a) The operating profits at 60%, 70% and 80% levels at current selling price and at proposed selling price.

(b) The percentage increase in the present output which will be required to maintain the present profit margin at the proposed selling price.

Solution

(a) (i) Comparative statement of operating profit at current selling price and proposed selling prices.

Particulars	Capacity		
	60%	70%	80%
1. Output (units)	6,000	7,000	8,000
	Rs.	Rs.	Rs.
Variable costs Rs. 3 per unit	18,000	21,000	24,000
Semi-variable cost	{ 6,000 3,000	{ 6,000 3,500	{ 6,000 4,000
Fixed Costs	20,000	20,000	24,000
Total Costs	47,000	50,500	58,000
Sales at Current Price	60,000	70,000	80,000
Profit at Current selling price	13,000	19,500	22,000
(ii) Sales at proposed selling price @ Rs. 9	54,000	63,000	72,000
Less : Total Cost	47,000	50,500	58,000
	7,000	12,500	14,000
(b) Proposed Selling Price	=	Rs. 9.00	
Variable Cost	=	3.50	
Contribution		5.50	
Present Profit	=	Rs. 13,000	
Fixed Cost (20,000 + 6,000)	=	26,000	
Required Contribution		39,000	

$$\begin{aligned} \text{Required output} &= \frac{\text{Required Contribution}}{\text{Contribution per unit}} \\ &= \text{Rs. } 39,000 + 5.5 = 7091 \text{ units} \\ \% \text{ Increase in present output} &= \frac{1,091}{6,000} \times 100 = 18.18\% \end{aligned}$$

Problem 118. (Process Costing—Normal/Abnormal Loss). A product is finished in three stages I, II, III.

At the first stage a quantity of 72,000 kg was delivered at cost of Rs. 2.50 per kg. The entire material was consumed.

The production particulars with the allocated expenses were as indicated in the table below.

Stage	Input	Output	Direct Wages	Fixed Overhead	Varying Overhead
	kg.	kg.	Rs.	%	%
I	72,000	67,680	7,500	150	200
II	65,000	60,125	12,000	125	150
III	55,600	50,000	14,500	200	250

(on direct wages)

The producer, as was his usual practice, assessed his cost at Rs. 6.77 per kg., based on his input expenditure and the finished output. With a selling price of Rs. 7.50 per kg. he estimated his profit at Rs. 36,500. If you do not approve of his assessment of the end results of the operation, convince him of the real end-results in a tabular form. You should assume the normal wastage as only 5% on input at each stage and any excess wastage should not be allowed to inflate the cost of the end product.

Solution : Statement showing production and cost data

Production Particular	Stage 1	Stage 2	Stage 3
	kgs.	kgs.	kgs.
Input	72,000	65,000	55,600
Output :			
Normal loss	3,600	3,250	2,780
Abnormal loss	720	1,625	2,820
Closing stock	2,680	4,525	—
Transfer to next stage/F. Goods	65,000	55,600	50,000
	72,000	65,000	55,600
Cost :	Rs.	Rs.	Rs.
Input Material	1,80,000	2,03,125	2,23,413
Direct Wages	7,500	12,000	14,500
Fixed Overhead	11,250	15,000	29,000
Variable Overhead	15,000	18,000	36,250
Total Cost	2,13,750	2,48,125	3,03,163
Distribution :			
Cost of normal loss	2,250	5,300	1,390
Cost of abnormal loss	2,400	13,125	28,200
Cost of closing stock	2,680	4,525	—
Cost of finished goods	2,08,600	2,29,200	2,63,573
	2,13,750	2,48,125	3,03,163

*Rs. 2,13,750 + (72,000 kg – 3,600 kg) or @ Rs. 3.125 per kg.

@ Rs. 2,48,125 + (65,000 kg – 3,250 kg) or @ Rs. 4.0182 per kg

⊕ Rs. 3,03,163 + (55,600 kg – 2,780 kg) or @ Rs. 5.7395 per kg

The profit for the producer will be :

Sales realisation 50,000 × Rs. 7.50 = Rs. 3,75,000

Less Normal processing cost = 2,86,977

Margin 88,023

Less : Cost of abnormal loss

Stage 1	Rs. 2,250	
Stage 2	6,530	
Stage 3	16,186	<u>24,966</u>
Net profit		<u>63,057</u>

Producer's Estimated Profit = Rs. 36,500

Add Stock held over

Stage 1	Rs. 8,375	
Stage 2	Rs. 18,182	<u>26,557</u>
		<u>63,057</u>

Problem 119 (P/V Ratio). Cookwell Ltd. manufactures pressure cookers the selling price of which is Rs. 300 per unit. Currently the capacity utilisation is 60% with a sales turnover of Rs. 18 lakhs. The Company proposes to reduce the selling price by 20% but desires to maintain the same profit position by increasing the output. Assuming that the increased output could be made and sold, determine the level at which the Company should operate to achieve the desired objective.

The following further data are available :

- Variable cost per unit Rs. 60.
- Semi-variable cost (including a variable element of Rs. 10 per unit) Rs. 1,80,000.
- Fixed cost Rs. 3,00,000 will remain constant up to 80% level. Beyond this an additional amount of Rs. 60,000 will be incurred.

Solution :

Sales Volume at 60% Capacity = Rs. 18,00,000

Selling Price = Rs. 300

Variable cost = Rs. 60 + 10 = 70 (including variable portion of Semi-Variable Overhead)

Fixed Cost = Rs. 3,00,000 + (Rs. 1,80,000 – Rs. 60,000) = Rs. 4,20,000
(including fixed portion of semi-variable Overhead)

Contribution per unit = Rs. 300 – Rs. 70 = Rs. 230

Sales × P/V Ratio = Fixed cost + Profit

$18,00,000 \times \frac{230}{300} = 4,20,000 + \text{Profit}$

or Profit = Rs. 9,60,000

Revised selling price = Rs. 300 – 20% of Rs. 300 = Rs. 240

Total variable cost (as calculated above) = 70

Revised contribution 170

Sales × P/V Ratio = Fixed cost + Profit

or Sales × (170/240) = Rs. 4,20,000 + Rs. 9,60,000

Sales (in rupees) = Rs. 19,48,235

Sales in units = Rs. 19,48,235 ÷ Rs. 240 = 8,118 units

i.e., 81.18% capacity

It is given that beyond 80% capacity an additional amount of Rs. 60,000 will be incurred.

Now Contribution desired = Rs. 4,20,000 + Rs. 9,60,000 + Rs. 60,000
= Rs. 14,40,000

Sales × P/V Ratio = Rs. 14,40,000

∴ Required Sales in Rupees. = 14,40,000 × (240/170) = Rs. 20,32,941

∴ Required Sales in units = Rs. 20,32,941 ÷ 240 = 8,471 units

∴ 8,471 units should be sold to maintain the same profit or company should operate at 84.71% capacity.

Problem 120 (Material Cost Variance). A Company manufacturing 'distempers' operates a costing system. The standard cost for one of the products of the company shows the following material standards :

Materials	Quantity	Standard Price per Kg.	Total
A	40 kg.	Rs. 75	Rs. 3,000
B	10 kg.	50	500
C	50 kg.	20	<u>1,000</u>
Material Cost per unit (total)			<u>4,500</u>

The standard input mix is 100 kg and the standard output of finished product is 90 kg.

The actual results for the period are :

Material used

A = 2,40,000 kg. @ Rs. 80 kg.

B = 40,000 kg. @ Rs. 52 kg.

C = 2,20,000 kg. @ Rs. 21 kg.

Actual output of the finished product = 4,20,000 kg.

You are required to calculate the material price, mix and yield variances.

Solution :*For Material Cost Variances :***M₁— Actual Cost of material used :**

A	=	2,40,000 kg	×	Rs. 80	=	Rs. 1,92,00,000	
B	=	40,000 kg	×	Rs. 52	=	20,80,000	
C	=	<u>2,20,000 kg</u>	×	Rs. 21	=	<u>46,20,000</u>	Rs. 2,59,00,000
						<u>5,00,000</u>	

M₂— Standard Cost of Material used :

A	=	2,40,000 kg	×	Rs. 75	=	Rs. 1,80,00,000	
B	=	40,000 kg	×	Rs. 50	=	20,00,000	
C	=	<u>2,20,000 kg</u>	×	Rs. 20	=	<u>44,00,000</u>	Rs. 2,44,00,000
						<u>5,00,000</u>	

M₃— Standard cost of material, if it had been used in standard proportion :

A	=	5,00,000 × (40/100) × Rs. 75	=	Rs. 1,50,00,000	
B	=	5,00,000 × (10/100) × Rs. 50	=	Rs. 25,00,000	
C	=	5,00,000 × (50/100) × Rs. 20	=	Rs. 50,00,000	Rs. 2,25,00,000

M₄— Standard Material cost of output :

A	=	40 kg	×	75	=	Rs. 3,000
B	=	10 kg	×	50	=	500
C	=	<u>50 kg</u>	×	20	=	<u>1,000</u>
		<u>100 kg</u>				<u>4,500</u>

For 4,20,000 kg of output :

$$= 4,20,000 \text{ kg} \times (4,500/90) = \text{Rs. 210,00,000}$$

Calculation of Material Cost Variances :

$$\text{Mat. Price Variance} = M_1 - M_2 = 2,59,00,000 - 2,44,00,000 = \text{Rs. 15,00,000 (A)}$$

$$\text{Mat. Mix Variance} = M_2 - M_3 = 2,44,00,000 - 2,25,00,000 = \text{Rs. 19,00,000 (A)}$$

$$\text{Mat. Yield Variance} = M_3 - M_4 = 2,25,00,000 - 2,10,00,000 = \text{Rs. 15,00,000 (A)}$$

$$\text{Mat. Usage Variance} = M_2 - M_4 = 2,44,00,000 - 2,10,00,000 = \text{Rs. 34,00,000 (A)}$$

$$\text{Mat. Cost Variance} = M_1 - M_4 = 2,59,00,000 - 2,10,00,000 = \text{Rs. 49,00,000 (A)}$$

I.C.W.A. Final December 1989

Problem 121 (Automatic Machine vs. Semi-Automatic Machine—Cost Indifference Point). (A) A Company manufacturing electronic equipments is currently buying component A from a local supplier at a cost of Rs. 30 each. The company has under its consideration a proposal to install a machine for the manufacture of the component. Two alternative proposals are available as under :

- (a) installation of semi-automatic machine involving an annual fixed expenses of Rs. 18 lacs and a variable cost of Rs. 12 per component manufactured.
- (b) installation of automatic machine involving an annual fixed cost of Rs. 30 lacs and a variable cost of Rs. 10 per component manufactured.

Required :

- (i) Find the annual requirement of components to justify a switch over from purchase of components to (a) manufacture of the same by installing semi-automatic machine and (b) manufacture of the same by installing automatic machine.
- (ii) If the annual requirements of the component is 5,00,000 units, which machine would you advise the company to install.
- (iii) At what annual volume would you advise the company to select automatic machine instead of semi-automatic machine.

(B) (Return on Capital Employed). A company has finished the following cost data :

	Rs./unit
Direct Materials	11.20
Direct wages	3.00
Variable overheads	0.80
Fixed factory overheads	Rs. 6,60,000 p.a.
Fixed Selling and Administration overheads	Rs. 3,60,000 p.a.
Annual sales	4,00,000 units
Capital employed in fixed assets	Rs. 9,00,000

Capital employed in current assets 50% of sales. Determine the selling price per unit to yield 20% return on capital employed.

Solution

(A)	Semi-Automatic Machine	Automatic Machine
(i) Purchase Price of the component	Rs. 30	Rs. 30
Variable Cost	<u>12</u>	<u>10</u>
Saving	<u>18</u>	<u>20</u>
Fixed Cost	Rs. 18,00,000	Rs. 30,00,000
Components required to be produced to justify the installation of machine	$= 18,00,000 + 18$ $= 1,00,000$	$30,00,000 + 20$ $= 1,50,000$
(ii) If annual requirements is 5,00,000 units		
Variable costs	Rs. 60,00,000	Rs. 50,00,000
Fixed cost	<u>18,00,000</u>	<u>30,00,000</u>
	78,00,000	80,00,000

Company should instal semi-automatic machine.

- (iii) This is a problem of determining *Cost Indifference Point*, i.e., the point of sales at which total cost under two alternatives will be equal. Suppose that point is x units.

$$\therefore 12x + \text{Rs. } 18,00,000 = 10x + \text{Rs. } 30,00,000$$

$$\therefore x = 6,00,000 \text{ units}$$

- \therefore Up to 6,00,000 units company should use Semi-Automatic Machine. Beyond this point there is justification for the company to instal the automatic machine to gain advantage of lower variable cost per unit.

$$(B) \text{ Capital Employed} = \text{Fixed Assets} + \text{Net Current Assets}$$

$$= \text{Rs. } 9,00,000 + 50\% \text{ of sales}$$

$$\text{Profit} = 20\% \text{ of capital employed}$$

$$= 0.2 (9,00,000 + 50\% \text{ of sales})$$

$$= 1,80,000 + 0.10 \text{ of sales}$$

$$\text{Variable Cost} = 4,00,000 \times 15 = \text{Rs. } 60,00,000$$

$$\text{Fixed Cost} = 6,60,000 + 3,60,000 = \underline{10,20,000}$$

$$\underline{70,20,000}$$

$$\text{Sales} = \text{Cost} + \text{Profit} = \text{Rs. } 70,20,000 + 1,80,000 + 10\% \text{ of sales}$$

$$\text{or Sales} = \text{Rs. } 72,00,000 + 10\% \text{ Sales.}$$

$$\text{or } 90\% \text{ Sales} = \text{Rs. } 72,00,000 \therefore 100\% \text{ Sales} = \text{Rs. } 80,00,000$$

$$\therefore \text{Selling price} = \text{Rs. } 80,00,000 \div 4,00,000 \text{ units} = \text{Rs. } 20 \text{ per unit.}$$

For question on Selling Agents Vs Own Sales Force, refer to Problem 10-41.

Problem 122. (Variance Analysis—Operating Statement). The standard cost card per unit of output of Product K produced by a firm is as under :

	Rs.
Direct Materials A. 10 kg. @ Rs. 10	100
B. 5 kg. @ Rs. 3	15
Direct wages 5 Hrs. @ Rs. 3	15
Fixed production overheads	<u>25</u>
Total Standard Cost	155
Standard Gross Profit	<u>45</u>
Standard Selling Price	<u>200</u>

The fixed production overhead has been absorbed on the expected annual output of 10,800 units produced at an even flow throughout the year.

During the month of November 1989, the following were the actual results for an actual production of 800 units.

Sales 800 units Rs. 200	Rs. <u>1,60,000</u>
Direct Materials A. 7,800 kg	79,950
B. 4,300 kg.	11,825
Direct wages 4,200 hours	12,075
Fixed overheads	<u>23,500</u>
Total	<u>1,27,350</u>
Gross Profit	<u>32,650</u>

The material price variance is extracted at the time of receipt of materials. Materials purchased were A 9000 kg @ Rs. 10.25 per kg. B 5000 kg @ Rs. 2.75 per kg.

Required :

- (i) Calculate all variances.
- (ii) Prepare an operating statement showing the standard gross profit, variances and actual gross profit.
- (iii) Explain the reason for the difference in the actual gross profit given above and the actual gross profit arrived at by you.

Solution : Calculation of variances

Cost variances :

For Material Cost Variances :

M₁ — Actual cost of material purchased :

A	9,000 × Rs. 10.25	=	Rs. 92,250	
B	5,000 × Rs. 2.75	=	<u>13,750</u>	1,06,000

M_{2(a)}—Standard cost of material purchased :

A	9,000 × Rs. 10	=	90,000	
B	5,000 × 3	=	<u>15,000</u>	1,05,000

M_{2(a)}—Standard cost of material used :

A	7,800 × 10	=	78,000	
B	<u>4,300 × 3</u>	=	<u>12,900</u>	90,900
	<u>12,100</u>			

(∵ Material Price Variance is calculated at the time of purchase)

M₃— Standard cost of material, if it has been used in standard proportion

A	12,100 × (10/15) × 10	=	Rs. 80,667	
B	12,100 × (5/15) × 3	=	<u>12,100</u>	92,767

M₄— Standard material cost of output

$$800 \text{ units} \times (10 \text{ kg} \times \text{Rs. } 10 + 5 \text{ kg} \times \text{Rs. } 3) = 92,000$$

Material Cost Variances :

$$\text{Material Price Variance} = M_1 - M_2 = \text{Rs. } 1,06,000 - \text{Rs. } 1,05,000 = \text{Rs. } 1,000 \text{ (A)}$$

$$\text{Material Mix Variance} = M_2 - M_3 = \text{Rs. } 90,900 - \text{Rs. } 92,767 = \text{Rs. } 1,867 \text{ (F)}$$

$$\text{Material Yield Variance} = M_3 - M_4 = \text{Rs. } 92,767 - \text{Rs. } 92,000 = \text{Rs. } 767 \text{ (A)}$$

$$\text{Material Usage Variance} = M_2 - M_4 = \text{Rs. } 90,900 - \text{Rs. } 92,000 = \text{Rs. } 1,100 \text{ (A)}$$

For Labour Cost Variances

$$L_1 \text{— Actual payment made for actual hours worked (given)} = \text{Rs. } 12,075$$

$$L_2 \text{— Payment involved if the payment had been at standard rate} \\ 4,200 \text{ hrs} \times 3 = \text{Rs. } 12,600$$

L₃ & L₄—Not applicable

L_5 — Standard labour cost of output achieved
 $800 \text{ units} \times (5 \text{ hrs} \times \text{Rs. } 3) = 12,000$

Calculation of Variances :

Wage Rate Variance = $L_1 - L_2 = \text{Rs. } 12,075 - \text{Rs. } 12,600 = \text{Rs. } 525 \text{ (F)}$

Wage Efficiency Variance = $L_2 - L_5 = \text{Rs. } 12,600 - \text{Rs. } 12,000 = \text{Rs. } 600 \text{ (A)}$

For Fixed Overhead Variances :

FO_1 —Actual fixed overhead incurred (given) = Rs. 23,500

FO_2 — Budgeted fixed overhead for the period
 $(10,800 \text{ units} + 12) \times \text{Rs. } 25 = \text{Rs. } 22,500$

FO_3 — All hours were available.

FO_4 — Fixed overhead for actual hours worked at standard rate
 $4,200 \text{ hrs.} \times (\text{Rs. } 25 + 5 \text{ hrs.}) = \text{Rs. } 21,000$

FO_5 — Standard fixed overhead for production
 $800 \text{ units} \times \text{Rs. } 25 = \text{Rs. } 20,000$

Fixed O.H. Exp. Variance = $FO_1 - FO_2 = \text{Rs. } 23,500 - \text{Rs. } 22,500 = \text{Rs. } 1,000 \text{ (A)}$

Fixed O.H. Cap. Variance = $FO_2^* - FO_4 = \text{Rs. } 22,500 - \text{Rs. } 21,000 = \text{Rs. } 1,500 \text{ (A)}$

Fixed O.H. Effi. Variance = $FO_4 - FO_5 = \text{Rs. } 21,000 - \text{Rs. } 20,000 = \text{Rs. } 1,000 \text{ (A)}$

* FO_2 taken as base, because FO_3 is nil.

For Sales Margin Variance :

Actual Sales Margin = Actual sales—Std. Cost = $\text{Rs. } 200 - \text{Rs. } 155 = \text{Rs. } 45$

SM_1 — Actual Sales Margin on actual sales ($800 \times \text{Rs. } 45$) = Rs. 36,000

SM_2 — Standard Sales Margin on actual sales $800 \times \text{Rs. } 45 = \text{Rs. } 36,000$

SM_3 — As there is no mix, it is nil NIL

SM_4 — Budgeted Sales Margin $900 \times \text{Rs. } 45 = \text{Rs. } 40,500$

Sales Margin Price Variance = $SM_1 - SM_2 = \text{Rs. } 36,000 - 36,000 = \text{NIL}$

Sales Margin Quantity Variance = $SM_2 - SM_4 = \text{Rs. } 36,000 - \text{Rs. } 40,500 = \text{Rs. } 4,500 \text{ (A)}$

(ii) Budgeted Profit =

Sales $800 \times \text{Rs. } 200 = \text{Rs. } 1,60,000$

Less Standard Cost ($800 \times \text{Rs. } 155$) = 1,24,000

Profit on actual sales as per standard 36,000

Less Cost Variances :

	<i>Fav.</i>	<i>Adv.</i>
Mat. Price Variance		1,000
" Mix "	1,867	
" Yield "		767
Wage Rate "	525	
" Efficiency "		600
Fixed O.H. Exp. "		1,000

" Capacity "		1,500	
" Efficiency "		<u>1,000</u>	
	<u>2,392</u>	<u>5,867</u>	<u>3,475 (A)</u>
Actual Profit			<u>32,525</u>

Alternatively, reconciliation statement can be prepared as follows :

Budgeted Profit $(10,800 + 12) \times \text{Rs. } 45$ = Rs. 40,500

Net Effect of Variances :

	Fav.	Adv.	
Sales Margin Quantity Variance	—	4,500	
Cost Variance (as above)	—	<u>3,475</u>	<u>7,975</u>
			<u>32,525</u>

Note : If price variance is calculated at the time of issue, material price variance will be :

M ₁ —	A	7,800 × 10.25	=	Rs. 79,950	
	B	4,300 × 2.75	=	<u>11,825</u>	Rs. 91,775
M ₂ —	A	7,800 × 10.00	=	78,000	
	B	4,300 × 3.00	=	<u>12,900</u>	• 90,900

Mat. Price Variance = M₁ – M₂ = Rs. 91,775 – Rs. 90,900 = Rs. 875(A)

Problem 123. (Break-even Analysis). Processed Foods Ltd., which had recently launched a new product, Tastewell after initial estimation of demand and costs, would like to have a review through fresh projections based on available information on actual production, costs and revenues. The product is sold in one kg. home packs. Performance pertaining to the previous two quarters, detailed below, can be taken as presenting representative pattern of costs and operations that can be projected to the future. There were no inventories at the end of each quarter. Tax incidence can be reckoned at 50 per cent.

	First Quarter Rs.		Second Quarter Rs.
Sales 60,000 packs at Rs. 160	96,00,000	(80,000 packs at Rs. 160)	128,00,000
Cost of goods sold	<u>58,00,000</u>		<u>70,00,000</u>
Gross Profit	38,00,000		58,00,000
Selling and Administration	<u>48,00,000</u>		<u>52,00,000</u>
Profit (Loss) before Tax	(10,00,000)		6,00,000
Tax (50%)	—		<u>3,00,000</u>
Profit (Loss) after Tax	<u>(10,00,000)</u>		<u>3,00,000</u>

Required :

- (a) What is Break-even volume in terms of Quarterly sales of home packs ?

- (b) On an investment of Rs. 10,00,000 for Tastewell, an after-tax return of 15 per cent is expected. What should be the volume of sales and the sales revenue to get this return?
- (c) The Marketing Manager of Processed Foods Ltd., expects a 20 per cent increase in sales over the second quarter if a reduction of Rs. 10 per pack in price is coupled with an advertisement outlay of Rs. 6,00,000. Should this proposal be accepted?

Solution: (a) $P/V \text{ ratio} = \frac{\text{Change in profit} + \text{change in sales}}{\text{Change in sales}}$
 $= \frac{\{Rs. 6,00,000 - (-10,00,000)\}}{\{Rs. 128,00,000 - Rs. 96,00,000\}} = 50\%$

Sales \times P/V ratio = F + P

or $Rs. 128,00,000 \times 50\% = F + Rs. 6,00,000$ or $F = 58,00,000$

Break-even Sales \times P/V ratio = Fixed Cost

\therefore BES = $Rs. 58,00,000 + 50\% = Rs. 1,16,00,000$

or BES = $1,16,00,000 \div Rs. 160 = 72,500$ Packs

- (b) On an investment of Rs. 10,00,000 after-tax return expected is 15%
 or Rs. 1,50,000

\therefore Pre-tax profit will be Rs. 3,00,000 because tax incidence is 50%

We know: $S \times P/V \text{ ratio} = F + P$

or $S \times 50\% = Rs. 58,00,000 + Rs. 3,00,000$ or $S = Rs. 1,22,00,000$

\therefore Required Sales = $Rs. 1,22,00,000$ or $1,22,00,000 \div 160 = 76,250$ packs

- (c) New selling price = $Rs. 160 - Rs. 10 = Rs. 150$

New fixed cost = $Rs. 58,00,000 + Rs. 6,00,000 = Rs. 64,00,000$

Earlier P/V ratio was 50% \therefore Variable cost per unit = $160 \times 0.50 = Rs. 80$

Revised P/V ratio = $\{Rs. 150 - Rs. 80\} / Rs. 150$

New Sales $\{80,000 \text{ packs} + 20\%\} \times Rs. 150 = Rs. 1,44,00,000$

\therefore New Profit: $S \times P/V \text{ ratio} = F + P$

Or $Rs. 1,44,00,000 \times (70 + 150) = Rs. 64,00,000 + P$

or Profit = $Rs. 3,20,000$

\therefore Profit after tax = $Rs. 1,60,000$ (i.e. 50% of Rs. 3,20,000)

In second quarter profit after tax is Rs. 3,00,000. Acceptance of this proposal will reduce it to Rs. 1,60,000. Therefore, proposal should not be accepted in the context of short-run decision making.

Problem 124 (Absorption Costing vs. Marginal Costing). Compact Ltd. drew up its budget for the year, segregating costs into fixed and variable costs. The direct material cost has been determined at Rs. 80 per unit of product manufactured; direct labour, Rs. 50 per unit; variable overhead, Rs. 20 per unit and fixed overhead, Rs. 60,00,000. Administration and selling expenses will have a fixed component of Rs. 20,00,000 and a variable component of Rs. 30 per unit sold. At a selling price of Rs. 500 per unit, a sales volume of 30,000 units was expected and the budget for the period was drawn up as below.

Budgeted Income Statement (Absorption Costing)

Sales (30,000 units at Rs. 500)	Rs.	Rs. 150,00,000
Cost of goods sold :		
Opening stocks	—	
Direct materials	24,00,000	
Direct labour	15,00,000	
Variable overhead	6,00,000	
Fixed overhead	60,00,000	
Closing stock	<u>—</u>	<u>105.00.000</u>
Gross Profit		45,00,000
Fixed Selling and Administration	20,00,000	
Variable Selling and Administration	<u>9.00.000</u>	<u>29.00.000</u>
Net Profit		<u>16.00.000</u>

The actual production for the year was 30,000 units, as budgeted. But only 20,000 unit could be sold, at Rs. 500 per unit. Before the close of the year, another 3,000 unit were sold to a foreign distributor at Rs. 300 per unit. The actual results for the year are presented below :

Actual Income Statement (Absorption Costing)

	Rs.	Rs.
Sales (20,000 units at Rs. 500)		
+ 3000 units at Rs. 300)		1,09,00,000
Cost of goods sold :		
Opening stock	—	
Direct Material	24,00,000	
Direct Labour	15,00,000	
Variable overhead	6,00,000	
Fixed overhead	<u>60.00.000</u>	
Cost of goods available	1,05,00,000	
Less Closing stock	<u>24.50.000*</u>	<u>80.50.000</u>
Gross Profit		28,50,000
Fixed Selling and Administration	20,00,000	
Variable Selling and Administration	<u>6.90.000</u>	<u>26.90.000</u>
Net Profit		<u>1.60.000</u>

Note : *Closing stock consists of 7,000 units at Rs. 350 each

$$\frac{\text{Cost of goods manufactured}}{\text{Units manufactured}} = \frac{105,00,000}{30,000} = \text{Rs. 350}$$

The Managing Director of Compact Ltd. was critical of the sale of 3,000 units to the foreign distributor at below cost. With a manufacturing cost of Rs. 350 per unit and variable selling cost of Rs. 30 per unit he felt that on the 3,000 units the company lost Rs. 2,40,000. Had it not been for this, he felt that the profit should have been Rs. 4,00,000, as against Rs. 1,60,000 reported. He was very much upset at what he considered to be the blunder of this special sale.

You have to explain to him the correct financial position.

- Prepare the absorption cost income statement assuming the company sold only 20,000 units at Rs. 500 and had not done the sale to the foreign distributor.
- Prepare a direct cost income statement based on actual sales and reconcile it to the actual absorption cost income statement.
- Prepare a direct cost income statement assuming sale of only 20,000 units at Rs. 500 and reconcile this with the comparative absorption cost income statement.
- Is Compact Ltd. better or worse off for having made the foreign sale.

Solution : Absorption Cost—Income Statement

(Assuming company sold only 20,000 units with no sale to foreign distributor)

Sales (20,000 × Rs. 500)	Rs.	Rs. 100,00,000
Cost of goods sold :		
Op./stock	—	
Direct Materials	24,00,000	
Direct Labour	15,00,000	
Variable Overheads	6,00,000	
Fixed Overhead	<u>60,00,000</u>	
Cost of goods produced	1,05,00,000	
Less Closing stock		
10,000 units × 350	<u>35,00,000</u>	<u>70,00,000</u>
Gross Profit		30,00,000
Selling & Adm. O.H.—Fixed	Rs. 20,00,000	
Selling & Adm. O.H.— Variable	<u>6,00,000</u>	<u>26,00,000</u>
Net Profit		<u>4,00,000</u>

The working supports the statement of Managing Director that profit under absorption cost basis will be higher, if foreign sale is not undertaken.

(b) Direct Cost Income Statement :

Sales {(20,000 × 500) + (3000 × 300)}	Rs. 1,09,00,000
Variable Cost of Goods sold :	
Direct Material	24,00,000
Direct Labour	15,00,000
Variable Overhead	<u>6,00,000</u>
Cost of goods produced*	45,00,000
Less cl./stock (7000 × Rs. 150)	<u>10,50,000</u>
	<u>34,50,000</u>
Variable Selling & Adm. (23,000 × Rs. 30)	<u>6,90,000</u>
Contribution	67,60,000
Less Fixed Cost :	
— Production	Rs. 60,00,000
— Selling & Admn.	<u>20,00,000</u>
Net Loss	<u>12,40,000</u>

Reconciliation :

Net Profit as per Absorption Costing	Rs. 1,60,000
Less : Fixed cost relating to closing stock not charged to P & L A/c for this year $(7,000 \times (\text{Rs. } 350 - \text{Rs. } 150))$	<u>14,00,000</u>
Net loss	<u>12,40,000</u> *

* $\text{Rs. } 45,00,000 \div 30,000 = \text{Rs. } 150 \text{ per unit}$

(c) Direct Cost Income Statement.

(Assuming that there is sale of only 20,000 units)

Sales $(20,000 \times \text{Rs. } 500)$	Rs. 1,00,00,000
Less Variable Cost of goods sold	
Direct Materials	24,00,000
Direct Labour	15,00,000
Variable Overhead	<u>6,00,000</u>
V. Cost of goods produced	45,00,000
Less cl/stock	<u>15,00,000</u> *
	<u>30,00,000</u>
	70,00,000
Less Variable Selling & Admn. $(20,000 \times \text{Rs. } 30)$	<u>6,00,000</u>
Less Fixed Cost	64,00,000
Production	Rs. 60,00,000
Selling & Admn.	<u>20,00,000</u>
Net loss	<u>16,00,000</u>

Reconciliation :

Net profit as per absorption costing	Rs. 4,00,000
Less : Fixed O.H. relating to closing stock i.e. $10,000 \times (\text{Rs. } 350 - \text{Rs. } 150)$	<u>20,00,000</u>
Direct Costing Net loss	<u>16,00,000</u>

* $10,000 \text{ units } (45,00,000 \div 30,000 \text{ units})$

(d) Absorption costing income statement leads to the conclusion that sale to foreigner was not a good deal. Based on direct cost income statement it becomes clear that sale to foreigner brings down the loss to Rs. 12,40,000 from Rs. 16,00,000 when there was no sale. Direct costing statement gives a better reflection of company's financial position.

Problem 125 (Marketing Decision). Home Comforts Ltd. deal in three products Ace, Nice and Grace and these are sold directly through salesmen in three zones, Prime, Extension and Outreach. The responsibility for sales promotion rests with the headquarters and so does the overall control of distribution and sales.

Statement of Sales are

Ace	100	Percent of sales
Nice	200	Percent of sales
Grace	300	Percent of sales

Details of sales and selling and distribution expenses for the year are as follows :

		<i>Sales</i>	<i>S & D Expenses Allocated Direct</i>
Prime Zone :	Ace	Rs. 9,00,000	Rs. 63,990
	Nice	9,00,000	84,465
	Grace	<u>4,50,000</u>	<u>47,160</u>
		<u>22,50,000</u>	<u>1,95,615</u>
Extension Zone :	Ace	6,75,000	46,710
	Nice	4,50,000	47,700
	Grace	<u>2,25,000</u>	<u>23,940</u>
		<u>13,50,000</u>	<u>1,18,350</u>
Outreach Zone :	Ace	2,25,000	18,900
	Nice	1,80,000	15,165
	Grace	<u>4,95,000</u>	<u>66,375</u>
		<u>9,00,000</u>	<u>1,00,440</u>

Selling and distribution expenses at headquarters are as follows :

Office expenses	Rs 94,500
Advertisement	1,35,000
Other expenses	1,21,500

Advertisement costs are allocated to zones and products on the basis of sales. Office expenses and other expenses are apportioned equally to the zones or the products while computing the profit or loss for the zones or the products as the case may be.

Prepare a comparative Profit and Loss Statements presenting zonal performance as distinct from product performance.

Solution

(a) Comparative Zonal Profit and Loss Statement

	<i>Prime</i>	<i>Extension</i>	<i>Outreach</i>	<i>Total</i>
Sales (Rs.)	<u>22,50,000</u>	<u>13,50,000</u>	<u>9,00,000</u>	<u>45,00,000</u>
Cost of Sales				
Ace	7,65,000	5,73,750	1,91,250	15,30,000
Nice	7,20,000	3,60,000	1,44,000	12,24,000
Grace	<u>3,37,500</u>	<u>1,12,750</u>	<u>3,71,250</u>	<u>8,77,500</u>
Total Cost of Sales	<u>18,22,500</u>	<u>11,02,500</u>	<u>7,06,500</u>	<u>36,31,500</u>
Gross Profit	<u>4,27,500</u>	<u>2,47,500</u>	<u>1,93,500</u>	<u>8,68,500</u>

Selling costs :

Direct	1,95,615	1,18,350	1,00,440	4,14,405
Apportioned	1,50,000	1,00,000	27,000	3,57,000
Office Expenses	1,50,000	1,00,000	31,500	3,81,500
Advertisement	4,50,000	3,00,000	45,000	8,95,000
Other Expenses	1,50,000	1,00,000	27,000	3,77,000
Total Selling Costs	<u>4,45,615</u>	<u>3,18,350</u>	<u>2,94,440</u>	<u>10,58,405</u>

(a) Comparative Zonal Profit and Loss Statement :

	<i>Ace</i>	<i>Nice</i>	<i>Grace</i>	<i>Total</i>
Sales :				
Prime	Rs. 9,00,000	Rs. 9,00,000	Rs. 4,50,000	Rs. 22,50,000
Extension	6,75,000	4,50,000	2,25,000	13,50,000
Outreach	<u>2,25,000</u>	<u>1,80,000</u>	<u>4,95,000</u>	<u>9,00,000</u>
Total Sales	<u>18,00,000</u>	<u>15,30,000</u>	<u>11,70,000</u>	<u>45,00,000</u>
Cost of Sales	<u>15,30,000</u>	<u>12,24,000</u>	<u>8,77,500</u>	<u>36,31,500</u>
Gross Profit	<u>2,70,000</u>	<u>3,06,000</u>	<u>2,92,500</u>	<u>8,68,500</u>
Selling costs :				
Direct	1,29,600	1,47,330	1,37,475	4,14,405
Advertisement	54,000	45,900	35,100	1,35,000
Office Expenses	31,500	31,500	31,500	94,500
Other Expenses	<u>40,500</u>	<u>40,500</u>	<u>40,500</u>	<u>1,21,500</u>
Total Selling Cost	<u>2,55,600</u>	<u>2,65,230</u>	<u>2,44,575</u>	<u>7,65,405</u>
Net Profit/loss	<u>14,400</u>	<u>40,770</u>	<u>47,925</u>	<u>1,03,095</u>

Problem 126 (Sales Mix). Novelties Ltd. seeks your advice on production mix in respect of the three products Super, Bright and Fine. You have the following information :

Data for Standard Costs per unit :

	<i>Super</i>	<i>Bright</i>	<i>Fine</i>
Direct Materials	Rs. 320	Rs. 240	Rs. 160
Variable overhead	16	40	24
Direct Labour :			
<i>Department</i>	<i>Rate per Hour</i>	<i>Hours</i>	<i>Hours</i>
A	Rs. 8.00	6	10
B	16.00	6	15

From current budget, you have further details as below :

	<i>Super</i>	<i>Bright</i>	<i>Fine</i>
Annual production (Nos.)	5,000	6,000	10,000
Selling Price per unit (Rs.)	624	800	480

Fixed Overhead : Rs. 16,00,000

Sales department's estimate of maximum

possible sales in the coming year (Nos.) 6,000 8,000 12,000

You are also to note that there is a constraint on supply of labour in Department A and its manpower cannot be increased beyond its present level.

Suggest the best production and sales mix from the standpoint of maximum profitability. Prepare statements setting out the profits resulting from the budgeted production and the best alternative suggested by you.

Solution :**(a) Statement of Profit from Budgeted Production**

	<i>Super</i>	<i>Bright</i>	<i>Fine</i>	<i>Total</i>
Annual production (Nos.)	<u>5,000</u>	<u>6,000</u>	<u>10,000</u>	<u>21,000</u>
Sales (Rs.)	<u>31,20,000</u>	<u>48,00,000</u>	<u>48,00,000</u>	<u>127,20,000</u>
Direct Materials	16,00,000	14,40,000	16,00,000	46,40,000
Deptt. Wages :				
Deptt. A	2,40,000	4,80,000	4,00,000	11,20,000
Deptt. B	4,80,000	14,40,000	17,60,000	36,80,000
Variable O.H.	<u>80,000</u>	<u>2,40,000</u>	<u>2,40,000</u>	<u>5,60,000</u>
Variable Cost	<u>24,00,000</u>	<u>36,00,000</u>	<u>40,00,000</u>	<u>100,00,000</u>
Contribution	<u>7,20,000</u>	<u>12,00,000</u>	<u>8,00,000</u>	<u>27,20,000</u>
Fixed overheads				<u>16,00,000</u>
Profit				<u><u>11,20,000</u></u>

Determination of most profitable mix

- (i) Hours in department A. represent the key factor. These available hours in Deptt. A which cannot be increased are :

Super	5,000	×	6	=	30,000	hrs.
Bright	6,000	×	10	=	60,000	hrs.
Fine	10,000	×	5	=	<u>50,000</u>	hrs.
					<u>1,40,000</u>	

- (ii) Contribution per unit of limiting factor, i.e., labour hour in Deptt. A.

	<i>Super</i>	<i>Bright</i>	<i>Fine</i>
Unit Sale price	R. 624	Rs. 800	Rs. 480
Marginal Cost per unit	<u>350</u>	<u>600</u>	<u>400</u>
Contribution per unit	<u>134</u>	<u>200</u>	<u>80</u>
Labour hours in Deptt. A	<u>6</u>	<u>10</u>	<u>5</u>
Contribution per labour hour in Deptt. A	<u>22</u>	<u>20</u>	<u>16</u>

∴ Optimum production plan is :

Maximum of Super i.e., 6,000 × 6	=	36,000	hrs.
Maximum of Bright i.e., 8,000 × 10	=	80,000	hrs.
Balance for Fine 4,800 × 5	=	<u>24,000</u>	hrs.
		<u>1,40,000</u>	hrs.

$$* \{1,40,000 - (36,000 + 80,000)\} \div 5 = 4,800 \text{ units}$$

Therefore full estimated demand of Super and Bright should be produced and only 4,800 units of Fine should be produced.

(iii) Statement showing profit relating to optimum production mix proposed above.

	<i>Super</i>	<i>Bright</i>	<i>Fine</i>	<i>Total</i>
Units	<u>6,000</u>	<u>8,000</u>	<u>4,800</u>	<u>18,800</u>
	Rs.	Rs.	Rs.	Rs.
Sales	<u>37,44,000</u>	<u>64,00,000</u>	<u>23,04,000</u>	<u>124,48,000</u>
Direct Materials	19,20,000	19,20,000	7,68,000	46,08,000
Direct Labour (Deptt. A)	2,88,000	6,40,000	1,92,000	11,20,000
" (Deptt. B)	5,76,000	19,20,000	8,44,800	33,40,800
Variable O.H.	<u>96,000</u>	<u>3,20,000</u>	<u>1,15,200</u>	<u>5,31,200</u>
	<u>28,80,000</u>	<u>48,00,000</u>	<u>19,20,000</u>	<u>96,00,000</u>
Contribution	8,64,000	16,00,000	3,84,000	28,48,000
Fixed Overhead				<u>16,00,000</u>
Profit				<u>12,48,000</u>

Problem 127. (Uncertainty and Capital Budgeting). Forward Planning Ltd. is considering whether to invest in a project which would entail immediate expenditure on capital equipment of Rs. 40,000.

Expected Sales from the Project are as follows :

<i>Probability</i>	<i>Sales Volume (units)</i>
0.10	2,000
0.25	6,000
0.40	8,000
0.15	10,000
0.10	14,000

Once sales are established at a certain volume in the first year, they will continue at that same volume in subsequent years. The unit selling prices will be Rs. 10, the unit variable cost Rs. 6 and the additional fixed costs will be Rs. 20,000 (all cash items).

The project would have a life of 6 years after which the equipment would be sold for scrap which would fetch Rs. 3,000.

You are required to find out :

- the expected value of the NPV of the project.
- the minimum volume of sales per annum required to justify the project.

The cost of capital of the company is 10%. Discount factor of Re. 1 per annum for 6 years at 10% is 4.355 and the discount factor of Re. 1 at the end of the sixth year at 10% is 0.5645. Ignore taxation.

Solution. The expected value of sales volume per annum

<i>Sales Volume (units)</i>	<i>Probability</i>	<i>Expected value of Sales Volume (units)</i>
2,000	0.10	200
6,000	0.25	1,500

8,000	0.40	3,200
10,000	0.15	1,500
14,000	0.10	<u>1,400</u>
		<u>7,800</u>

EV of contribution of 7,800 units = $7,800 \times (\text{Rs. } 10 - \text{Rs. } 6) = \text{Rs. } 31,200$.

All additional fixed costs are cash items (stated in question). EV of additional cash profits each year will be 11,200 i.e., Rs. 31,200 – Rs. 20,000.

Year	Cash flow	Discounting Factor	PV of Cash Flow
0	(40,000)	1.000	(40,000)
1-6	11,200	4.3550	48,776
6	3,000	0.5645	<u>1,694</u>
			<u>10,470</u>

(b) To break even NPV must be zero. Now it is possible to calculate PV of annual cash profit as follows :

Present Value

P.V. of capital outlay	Rs. 40,000
P.V. of residual value	<u>(1,694)</u>
PV of annual cash profit required for NPV of 0	<u>38,306</u>
Discounting factor of Re. 1 p.a. for 6 years @ 10%	= 4.355
Annual cash profit required = $38,306 \div 4.355$	= Rs. 8,796
Additional Fixed Cost	<u>20,000</u>
Fixed cost	<u>28,796</u>

Contribution required for NPV=0 is 28,796

Annual sales required to break even = $28,796 \div 4 = 7,199$ units.

Problem 128 (Probability and Break-even Analysis). A firm wants to avoid risk and choose between either of two alternative products. Both the products have the same contributory margin of Rs. 4 per unit, the same increment in annual fixed costs (Rs. 4 lakhs) and require similar amounts of processing facilities. Both the products will have the same break-even volume of one lakh units and for any level of sales will yield the same profit contribution.

Given the Probability Distribution of Sales for Products 1 and 2, as under, which product the firm will prefer ?

Units Sold	Product 1	Product 2
50,000	0.1	0.2
75,000	0.2	0.3
100,000	0.3	0.2
125,000	0.3	0.1
150,000	0.1	0.1
225,000	0	0.1

Solution.

The expected value of sales of product 1 :

$$0.1 \times 50,000 + 0.2 \times 75,000 + 0.3 \times 1,00,000 + 0.3 \times 1,25,000 + 0.1 \times 1,50,000 = \text{Rs. } 1,02,500.$$

The expected value of sales of product 2 :

$$0.2 \times 50,000 + 0.3 \times 75,000 + 0.2 \times 1,00,000 + 0.1 \times 1,25,000 + 0.1 \times 1,50,000 + 0.1 \times 2,25,000 = \text{Rs. } 1,02,500.$$

Even though both the products have the same expected sales and hence the same expected profit, product 2 will be viewed as riskier because the probability is 0.5 that sales will be $\geq 75,000$ units compared to a probability of 0.3 for product 1. Product 2 has probability of 0.7 of being at Break Even Sales or below whereas product 1 has probability of 0.6 of this event.

Product 2 has a higher variance and higher probability of loss than product 1, though both have the same expected profit. If risk is to be avoided, the firm will prefer product 1.

*** Problem 129 (Internal Opportunity Cost).** V Ltd. manufactures desks. The following information is provided.

	Per Unit (Rs.)
Material (3 kg. @ 2 per kg.)	6
Labour	5
Variable Overheads	4
Allocated Fixed Overheads	2

Material is currently used to make chairs which provide contribution of Rs. 5 per unit. 2 kg. of material are required for each chair.

What is the minimum price per desk if :

- material is plentiful
- material is scarce.

Solution

- (i) Minimum Price = Incremental Cost of making desk
= Rs. 6 + Rs. 5 + Rs. 4 = Rs. 15 per desk
- (ii) Minimum Price = Incremental cost + Internal opportunity cost (contribution foregone)
= Rs. 15 + (Rs. 5 × 2 kg) × 3 kg = Rs. 22.50 per desk

Problem 130 (Optimal Pricing). SV Ltd. budgets to make 1,00,000 units of product P. The variable cost per unit is Rs. 10. Fixed costs are Rs. 6,00,000.

The Finance Director has suggested that the cost-plus approach should be used with a profit mark-up of 25%.

However, the Marketing Director disagreed and has supplied the following information :

Price per unit (Rs.)	Demand (Units)
18	84,000
20	76,000
22	70,000
24	64,000
26	54,000

As Management Accountant of the Company, analyse the above proposals and comment.

Solution :

Finance Directors Cost-plus approach

Variable Cost	=	Rs. 10
Fixed Cost	=	<u>6</u>
Total Cost	=	16
Profit	=	<u>4</u>
Selling Price	=	<u>20</u>

At this price, demand will be 76,000 units leaving a closing stock of 24,000 units, i.e., 1,00,000 units – 76,000. At this price, contribution will be = 76,000 × Rs. 10 = Rs. 7,60,000. After subtracting fixed costs of Rs. 6,00,000, the profit will be Rs. 1,60,000. The profit for other price can be calculated as follows :

Price	Contribution per unit	Demand (Units)	Total Contribution	Fixed Cost	Net Profit
18	Rs. 8	Rs. 84,000	Rs. 6,72,000	Rs. 6,00,000	Rs. 72,000
20	10	76,000	7,60,000	6,00,000	1,60,000
22	12	70,000	8,40,000	6,00,000	2,40,000
24	14	64,000	8,96,000	6,00,000	2,96,000
26	16	54,000	8,64,000	6,00,000	2,64,000

Marketing Director was correct, as Rs. 20 per unit is not the best price, because Rs. 24 per unit maximises profitability.

Problem 131 (Learning Curve). (a) Define 'Learning Curve Ratio'. What are the limitations of Learning Curve?

(b) Engine Ltd. manufacture engine mountings for widebodied airliners. They have been asked to bid on a prospective contract for 90 engine mountings for the Jumbo jet aircraft. They have just completed an initial run of 30 of these mountings at the following costs :—

Direct materials	Rs. 20,000
Direct labour (6,000 hours @ Rs. 4)	24,000
Tooling Cost (re-usable)	3,000
Variable Overhead (Rs. 0.50 per labour hour)	3,000
Fixed Overhead (Rs. 1 per labour hours)	<u>6,000</u>
	Rs. 56,000

An 80% learning curve is thought to be pertinent in this case. The marketing director believes that the quotation is unlikely to be accepted if it exceeds Rs. 1,10,000 and as the Company are short of work, he believes the contract to be vital.

You are required to comment whether it is worth accepting at Rs. 1,10,000. State your assumptions clearly.

Solution :

(a) Please refer to "Advanced Cost and Management Accounting—Text" by V.K. Saxena and C.D. Vashist.

(b) Labour hours required :

	<i>Cumulative quantity manufactured</i>	<i>Cumulative Hours</i>	<i>Cumulative Average hours per unit</i>
(i)	30	6,000	200, i.e., $6000 \div 30$
(ii)	60	9,600, i.e. (160×60)	160, i.e., 80% of 200
(iii)	120	15,360, i.e. (120×128)	128, i.e., 80% of 160
Additional hours for 90 = Hours required for 120 less hours required for original 30 units, for which initial run has already been completed.			
= $15,360 - 6,000 = 9,360$ hours			

∴ Incremental costs for 90 engines will be :

Direct Material	Rs. 60,000
Direct Labour $(9,360 \text{ hrs} \times 4)$	37,440
Tooling Cost	—
Variable O.H. $(9,360 \times 0.50)$	4,680
Fixed O.H.	—
	<u>1,02,120</u>

The contract is worth accepting, if more profitable work is not being turned away, as it yields a contribution of only Rs. 7,880, i.e., Rs. 1,10,000 – Rs. 1,02,120.

Problem 132 (Value Added). The following figures for a period were culled out from the books of Value for Value Corporation :—

Sales	Rs. 24,80,000
Purchase of Raw Materials	10,00,000
Agent's Commission	20,000
Consumable Stores	25,000
Packing Material	10,000
Stationery	10,000
Audit Fees	4,000
Staff Welfare Expenses	1,58,000
Insurance	26,000
Rent, Rate & Taxes	16,000
Managing Director's Remuneration	84,000
Travelling Expenses	21,000
Fuel and Oil	9,000
Electricity	5,000
Materials used in Repairs :	
Materials to Plant & Machinery	24,000

Materials to Buildings	10,000
Advertisement	25,000
Salaries and Wages	6,30,000
Postage and Telegrams	14,000
Contribution on Provident Fund etc.	60,000
Directors' Sitting Fees and Travelling Expenses	40,000
Subscriptions Paid	2,000
Carriage	22,000
Interest on Loans Taken	18,000
Dividend to Shareholders	30,000
Depreciation Provided	55,000
Income Tax Provided	1,00,000
Retained Earnings	1,25,000
Opening Stock : Raw Materials	85,000
Finished Goods	2,00,000
Closing Stock : Raw Materials	1,08,000
Finished Goods	2,40,000

From the above you are required to prepare a statement detailing the Source and Disposal of Added Value. Does your statement corroborate the assertion of the chairman of the company in the Annual General Meeting that 75% of Added Value is accounted by Employee Costs ?

Solution : Statement showing the sources and Disposal of Added Value

Sources :

Sales	Rs. 24,80,000
Less Agent's commission	<u>20,000</u>
	24,60,000
Add Change in Finished Stocks	<u>40,000</u> ⊕
Gross Output	25,00,000

Less :

(a) *Raw Materials :*

Purchases	10,00,000
Less change in stock	<u>23,000</u> @
	9,77,000

Other Materials :

Consumables	25,000
Packing Material	10,000
Stationary	10,000
Fuel and Oil	9,000
Electricity	5,000
Repair—Plant & Mach.	24,000
Repair—Building	<u>10,000</u>
Cost of bought-in-inputs	10,70,000

(b) Purchased Services :

Audit fee	4,000	
Insurance	26,000	
Rent, Rates and Taxes	16,000	
Travelling expenses.	21,000	
Advertisement	25,000	
Postage & Telegraph	14,000	
Subscriptions	2,000	
Carriage	<u>22,000</u>	<u>12,00,000</u>
Added Value		<u>13,00,000</u>

Disposals :**To Employees Costs**

M. D's remuneration	Rs. 84,000	Rs.
Director's sitting fee and expenses	40,000	
Salaries & Wages	6,30,000	
Contributions to P.F.	60,000	
Staff Welfare exp.	<u>1,58,000</u>	9,72,000

To Government

Tax Provided		1,00,000
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To Providers of Capital

Interest on loan	18,000	
Dividend	<u>30,000</u>	48,000

To Re-investment in business

Depreciation	55,000	
Retained Earnings	<u>1,25,000</u>	<u>1,80,000</u>

Added Value		<u>13,00,000</u>
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75% of Added Value = 9,75,000

Employed cost is Rs. 9,72,000 about 75%

Chairman's statement is correct.

⊕ This adjustment is necessary because the cost relating to this closing stock stands included in purchases.

@ This adjustment is necessary so that raw material actually used is deducted from revenue.

C.S. Inter December 1989

Problem 133 (Product Mix). A farmer asks your recommendation for optimal mix of production for the coming year. The current data is given below:]

	Items produced			
	A	B	C	D
Area occupied (acres)	25	20	30	25
Yield per acre (tonnes)	10	8	9	12
Sale price per tonne (Rs.)	1,000	1,250	1,500	1,350

Variable cost per acre

Material (Rs.)	700	600	950	900
Labour (Rs.)	2,000	2,500	3,000	3,700
Variable overhead (Rs.)	2,000	2,000	2,000	2,000
Fixed overhead	Rs.			
Cultivation and growing	1,00,000			
Harvesting and transport	2,40,000			
Land revenue	90,000			
Administration	1,10,000			
	<u>5,40,000</u>			

The land which is being used for producing items A and B can be used for either items but not item C and D. The land which is being used for producing items C and D can be used for either items but not for items A and B.

In order to provide adequate market service, the farmer must produce each year at least 40 tonnes each of A and B and 36 tonnes each of C and D.

You are required to calculate the following :

(a) the profit for the current year; and

(b) The profit for the production mix which you would recommend.

Solution : (a) Profit for the current year

	<i>Products</i>			
	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>
Sale Value (per acre)	Rs. 10,000	Rs. 10,000	Rs. 13,500	Rs. 16,200
Variable cost (")	4,700	5,100	5,950	6,600
Contribution (")	5,300	4,900	7,550	9,600
Total area (in acres)	25	20	30	25
Total contribution	<u>1,32,500</u>	<u>98,000</u>	<u>2,26,500</u>	<u>2,40,000</u>
Total contribution	Rs. 6,97,000			
Less Fixed Overhead	<u>5,40,000</u>			
	<u>1,57,000</u>			

(b)

	<i>Products</i>			
	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>
Minimum Required Production (tonnes)	40	40	36	36
Yield per ton	10	8	9	12
Area required for minimum production (acres)	4	5	4	3
Surplus area allocated to profitable products	<u>36</u>	<u>—</u>	<u>—</u>	<u>48</u>
Total acres	<u>40</u>	<u>5</u>	<u>4</u>	<u>51</u>
Contribution per acres	Rs. <u>5,300</u>	Rs. <u>4,900</u>	Rs. <u>7,550</u>	Rs. <u>9,600</u>
Total Contribution (Rs.)	<u>2,12,000</u>	<u>24,500</u>	<u>30,200</u>	<u>4,89,600</u>

Total	Rs. 7,56,300
Less Fixed Cost	<u>5,40,000</u>
Profit	<u>2,16,300</u>

Note : The distribution of area to different products should be made in the manner given, because area is not interchangeable among all products. It is only partly interchangeable.

Production 134 (Abnormal loss and abnormal gain). Product B is obtained after it passes through three distinct processes. The following information is obtained from the accounts for the week ending May 30, 1990.

	<i>Process</i>			
	<i>Total</i>	<i>I</i>	<i>II</i>	<i>III</i>
	<i>(Rs.)</i>	<i>(Rs.)</i>	<i>(Rs.)</i>	<i>(Rs.)</i>
Direct material	7,542	2,600	1,980	2,962
Direct wages	9,000	2,000	3,000	4,000
Production overhead	9,000			

1,000 units at Rs. 3 each were introduced to Process I. There was no stock of materials or work-in-progress at the beginning or end of the period. The output of each Process passes direct to the next process and finally to finished stores.

Production overhead is recovered on 100% of direct wages.

The following additional data are obtained :

<i>Process</i>	<i>Output during the week</i>	<i>Percentage of normal loss to input</i>	<i>Value of scrap per unit (Rs.)</i>
I	950	5%	2
II	840	10%	4
III	750	15%	5

Prepare process cost accounts and abnormal loss or gain account.

Solution.

Process 1 Account

<i>Particulars</i>	<i>Units</i>	<i>Amount</i>	<i>Particulars</i>	<i>Units</i>	<i>Amount</i>
		Rs.			Rs.
To Units introduced	1,000	3,000	By Normal loss (50 × Rs. 2)	50	100
" D. Material		2,600	" Process II A/c @ Rs. 10	950*	9,500
" D. Wages		2,000			
" Production O.H.		2,000			
	<u>1,000</u>	<u>9,600</u>		<u>1,000</u>	<u>9,600</u>

*@ Rs. 10, i.e. (Rs. 9,600 – Rs. 100) ÷ (1000 – 50).

Process II Account

Particulars	Units	Amount	Particulars	Units	Amount
		Rs.			Rs.
To Process I A/c	950	9,500	By Normal loss (95 × Rs. 4)	95	380
" D. Material		1,980	" Abnormal loss @ Rs. 20	15⊕	300
" D. Wages		3,000	" Process III A/c @ Rs. 20	840⊕	16,800
" Production O.H.		3,000			
	950	17,480		950	17,480

⊕ Rs. 20 i.e. $(17,480 - 380) + (950 - 95)$

Process III Account

Particulars	Units	Amount	Particulars	Units	Amount
		Rs.			Rs.
To Process I A/c	840	16,800	By Normal loss (126 × Rs. 5)	126	630
" D. Material		2,962	By Finished stock A/c	750*	28,500
" D. Wages		4,000			
" Production O.H.		4,000			
" Abnormal gain	36*	1,368			
	876	29,130		876	29,130

*@ Rs. 38 per unit i.e. $\{(16,800 + 2,962 + 4,000 + 4,000 - 630) + (840 - 126)\}$

Abnormal Loss A/c

Particulars	Units	Amount	Particulars	Units	Amount
		Rs.			Rs.
To Process II A/c	15	300	By Debtors (sale of scrap)	15	60
			" P & L A/c		240
	15	300		15	300

Abnormal Gain A/c

Particulars	Units	Amount	Particulars	Units	Amount
		Rs.			Rs.
To Normal loss A/c (@ Rs. 5 per unit)	36	180	By Process III A/c	36	1,368
" P & L A/c		1,188			
	36	1,368		36	1,368

C.I.M.A. London May 1990

Problem 135. (Apportionment of Joint Costs). QR Limited operates a chemical process which produces four different products Q, R, S and T from the input of one raw material plus water. Budget information for the forthcoming financial year is as follows :

Product	Output in litres	Sales	Rs. '000
			Additional processing Rs. '000
			Raw materials cost
			268
			Initial processing cost
			464
Q	400,000	768	160
R	90,000	232	128
S	5,000	32	—
T	9,000	240	8

The company policy is to apportion to the costs prior to the split-off point on a method based on net sales value.

Currently, the intention is to sell product S without further processing but to process the other three products after the split-off point. However, it has been proposed that an alternative strategy would be to sell all four products at the split-off point without further processing. If this were done, the selling prices obtainable would be as follows :

	Rs. Per Litre
Q	1.28
R	1.60
S	6.40
T	20.00

You are required :

- to prepare a budgeted profit statement showing the profit or loss for each product, and in total, if the current intention is proceeded with;
- to show the profit or loss by product; and in total; if the alternative strategy were to be adopted ;
- to recommend what should be done and why, assuming that there is no more profitable alternative use for the plant.

Solution : Working showing the apportionment of pre-separation costs

Pre-separation costs				Rs. '000
				Raw materials cost
				268
				Initial processing cost
				<u>464</u>
				<u>732</u>
Product	Apportionment on net sales value method			Rs. '000
	Sales	Further processing	Net sales value	Pre-separation costs
Q	768	160	608	456

R	232	128	104	78
S	32	—	32	24
T	240	8	<u>232</u>	<u>174</u>
			<u>976</u>	<u>732</u>

(a) Statement showing budgeted profit or loss for each product and in total
(Rs. '000)

	Q	R	S	T	Total
Sales	768	232	32	240	1,272
Less : Pre-separation costs	<u>456</u>	<u>78</u>	<u>24</u>	<u>174</u>	<u>732</u>
	312	154	8	66	540
Less : Additional processing	<u>160</u>	<u>128</u>	<u>—</u>	<u>8</u>	<u>296</u>
Profit	152	26	8	58	244

(b) Statement showing profit or loss when products are sold at split-off point
(Rs. '000)

	Q	R	S	T	Total
Sales	512	144	32	180	868
Less : Pre-separation costs	<u>456</u>	<u>78</u>	<u>24</u>	<u>174</u>	<u>732</u>
	<u>56</u>	<u>66</u>	<u>8</u>	<u>6</u>	<u>136</u>

Note : By adopting alternative (b), the profit has come down from Rs. 2,44,000 to Rs. 1,36,000 and as such alternative (a) should be adopted.

(c) Statement showing differential cost and incremental income of the existing alternatives
(Rs. '000)

Product	Sales Revenue		Incremental Income	Differential Cost (Additional processing)	Profit/ (Loss)
	Fully processed	At split off point			
Q	768	512	256	160	96
R	232	144	88	128	(40)
T	240	180	60	8	<u>52</u>

By eliminating the further processing of T, profits will increase by Rs. 40,000 (the loss or net cost to the company of further processing). The overall profit will, therefore, rise from Rs. 2,44,000 as at (a) above to Rs. 2,84,000. Therefore, products R and S should be sold at split-off point while Q and T should be fully processed.

Problem 136. (Closing down a Department or Reduce Selling Prices). The directors of a family-owned retail departmental store were shocked to receive the following profit statement for the year ended 31st January 1990 :

	Rs. '000	Rs. '000	Rs. '000
Sales		5,000	
Less : Cost of sales		<u>3,398</u>	
			1,602

Wages—Departments	357	
—Office	70	
—Restaurant	<u>26</u>	453
Delivery costs		200
Departmental expenses		116
Salaries—directors and management		100
Directors' fees		20
Sales promotion and advertising		120
Store capacity costs <i>i.e.</i> rent, rates and energy		488
Interest on bank overdraft		20
Discounts allowed		25
Bad debts		15
Miscellaneous expenses		<u>75</u>
		<u>1,632</u>
Net loss		<u>(30)</u>

Management accounting has *not* been employed but the following breakdown has been extracted from the financial records :

	(Rs. '000)				Rs. '000
	Departments				Restaurant
	Ladies' wear	Men's wear	General	Toys	
Sales	800	400	2,200	1,400	200
Purchases	506	220	1,290	1,276	167
Opening stock	90	70	200	100	5
Closing stock	100	50	170	200	6
Wages	96	47	155	59	26
Departmental expenses	38	13	35	20	10
Sales promotion and advertising	10	5	30	75	—
Floor space occupied	20%	15%	20%	35%	10%

The directors are considering *two separate* proposals which are *independent of each other* :

(1) Closing the Toys Department.

(2) Reducing selling prices on Ladies' Wear and Men's Wear by 5% in the hope of boosting sales.

You are required :

- to present the information for the year to 31st January 1990 in a more meaningful way to aid decision making. Include any statistics or indicators of performance which you consider to be useful ;
- to show and explain the change in profit for a full year if the Toys Department were closed and if all other costs remain the same;
- to show for the Ladies' Wear and Men's Wear Departments, if selling prices are reduced by 5% and unit costs remain the same,
 - the increase in sales value (to the nearest thousand rupees) that would be required for a full year to maintain the gross profits, in rupees earned by each of these Departments; and

(ii) the increase (i) above expressed as a percentage of the sales for each Department to 31st January 1990;

(d) to state your views on both the proposals being considered by the directors and recommend any alternative action you think appropriate.

Solution : Break-up of cost of sales product-wise has not been given and the same should first be found out :

	Ladies Wear		Men's Wear		(Rs. '000) General		Toys	Restaurant	
Opening stock		90		70		200		100	5
Add : Purchases		<u>506</u>		<u>220</u>		<u>1,290</u>		<u>1,276</u>	<u>167</u>
		596		290		1,490		1,376	172
Less Closing stock		<u>100</u>		<u>50</u>		<u>170</u>		<u>200</u>	<u>6</u>
Cost of Sales		<u>496</u>		<u>240</u>		<u>1,320</u>		<u>1,176</u>	<u>166</u>

(Rs. '000)												
(a)	Ladies	%	Men's	%	General	%	Toys	%	Restaurant	%	Total	%
Sales	800	100	400	100	2,200	100	1400	100	200	100	5,000	100
Cost of sales	<u>496</u>		<u>240</u>		<u>1,320</u>		<u>1,176</u>		<u>166</u>		<u>3,398</u>	
Gross profit	304	38	160	40	880	40	224	16	34	17	1,602	32
Direct fixed costs												
Wages	96		47		155		59		26		383 [@]	
Expenses	38		13		35		20		10		116	
Sales and advertising	<u>10</u>		<u>5</u>		<u>30</u>		<u>75</u>		<u>---</u>		<u>120</u>	
Gross profit	<u>144</u>		<u>65</u>		<u>220</u>		<u>154</u>		<u>36</u>		<u>619</u>	

Less Direct fixed cost	1600	200	95	24	660	30	70	5	24	10	967	20
Less : General fixed costs :												
Delivery costs								200				
Salaries								100				
Directors' fees								20				
Capacity costs								48%				
Interest								20				
Discount allowed								25				
Bad debts								15				
Office wages								70				
Miscellaneous								75			<u>1,013</u>	
Net loss											(30)	(1)

Gross profit/area % for each dept.	(Rs.) 15,200 (304/0.02)	10,667 (160/0.015)	44,000 (880/0.02)	6,400 (224/0.035)	3,400 (34/0.01)
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Gross profit less direct fixed cost/area % for each dept.	(Rs.) 8,000 (160/0.02)	6,333 (95/0.015)	33,000 (660/0.02)	2,000 (70/0.035)	(200) (2/0.01)
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[@] This comprises of Departmental wages (Rs. 3,57,000) and Restaurant wages (Rs. 26,000). However, office wages are shown under general fixed costs

(b) If the Toy Department is closed and all other costs remained the same, the departmental store would lose Rs. 2,24,000 gross profit which is generated by the Toy Department, but would also lose the specific departmental costs (wages, expenses and sales promotion and advertising— Rs. 1,54,000). The overall profit reduction would, therefore, be Rs. 70,000). (Rs. '000)

	<i>Ladies Wears</i>	<i>Men's Wear</i>
(c) Original Sales	800	400
Original gross profit	304	160
Revised sales (5% reduction)	760	380
Revised profit	264	140
Gross Margin Ratio	34.74%	36.84%
Increase in sales required to		
Maintain original profit	$\frac{304 \times 760}{264}$	$\frac{160 \times 380}{140}$
	875.15	434.29
Sales increase from original sales	75.15	34.29
% Increase	9.4%	8.6%

(d) The facilities vacated by closure of Toy Department should be alternatively used by other department or a new department. Mere closure of this department would reduce overall profit. Further, the proposed price reduction would be worthwhile if sales revenue increases of more than 9.4% and 8.6% respectively for Ladies' Wear and Men's Wear, could be expected. As Men's Wear has a slightly higher gross margin ratio, the sales revenue increase required is less.

The most profitable department is the General Department and perhaps efforts could be made to increase sales (improve sales mix) made by this department. The Restaurant is showing a negative result of Rs. 2,000 but this is very marginal and as it attracts shoppers who are likely to spend in the other departments, it ought to be kept open.

Problem 137. (Material and Labour Variances). A manufacturing company has recently introduced a system of standard costing and you, as the assistant management accountant, wish to demonstrate the value of the system to the management. The following data apply to period 4 which has a four-week financial period.

Direct materials

Purchases :	Material A	50,000	kilogrammes for Rs. 158,750
	Material B	25,000	kilogrammes for Rs. 105,000
Used :	Material A	4,800	kilogrammes
	Material B	1,800	kilogrammes

Direct labour

	<i>Actual hours worked</i>	<i>Wages paid</i>
Department 1	3,000	Rs. 11,800
Department 2	2,400	13,250
Budgeted normal capacity expressed in direct labour hours		
Department 1	3,400 hours	
Department 2	2,600 hours	

Other information

Standard cost for 1 unit of finished product

	<i>Quantity</i>	<i>Rate</i>	<i>Amount</i>
Direct material A	10 kgs	Rs. 3.25	Rs. 32.50
Direct material B	5 kgs	4.00	20.00
Direct wages Dept. 1	8 hours	4.00	32.00
Direct wages Dept. 2	5 hours	5.00	<u>25.00</u>
			<u>109.50</u>

It had been decided to extract material price variance at the time of receipt.

400 finished goods units were produced in the period.

You are required :

- to calculate price and usage variances for each of the direct materials A and B;
- to calculate rate and efficiency variances for the direct labour employed by each of Departments 1 and 2;
- to suggest one possible reason for each of the variances shown in your answers to (a) and (b) above without stating the same reason more than once;
- to calculate for Department 1 and for Department 2
 - the production volume ratio,
 - the efficiency ratio;

Solution (a) For calculating material price variancesM₁— A— Actual Cost of material purchased — Rs. 1,58,750

B— Actual Cost of material purchased — Rs. 1,05,000

M₂— A— Standard cost of material purchased—50,000 kg × Rs. 3.25

= Rs. 1,62,500

B— Standard cost of material purchased 25,000 kg × Rs. 4.00 = Rs. 1,00,000

Material Price Variance = M₁—M₂

A— Rs. 1,58,750 — Rs. 1,62,500 = Rs. 3,750 (F)

B— Rs. 1,05,000 — Rs. 1,00,000 = Rs. 5,000 (A)

1,250 (A)**For Material Usage Variance**M₂— Standard cost of material used

A— 4,800 kg × Rs. 3.25 = Rs. 15,600

B— 1,800 kg × Rs. 4.00 = 7,20022,800M₄— Standard material cost of output

A— 10 kg × Rs. 3.25 × 400 units = Rs. 13,000

B— 5 kg × Rs. 4.00 × 400 units = 8,00021,000

Material Usage Variance = $M_2 - M_4$

A —	Rs. 15,600 - Rs. 13,000	= 2,600 (A)
B —	Rs. 7,200 - Rs. 8,000	= <u>800 (F)</u>
		<u>1,800 (A)</u>

b) For Labour Cost Variances :

L_1 —Actual Payment for actual hours worked :

Deptt. 1 for 3,000 hrs.	Rs. 11,800
Deptt. 2 for 2,400 hrs.	Rs. <u>13,250</u>
	<u>25,050</u>

L_2 —Payment involved if the workers had been paid at standard rate—

Deptt. 1 for 3,000 hrs. \times 4.00	Rs. 12,000
Deptt. 2 for 2,400 hrs. \times 5.00	<u>12,000</u>
	<u>24,000</u>

L_3 & L_4 not required, as efficiency variance is asked

L_5 —Standard labour cost of output

Deptt. 1 — 8 hrs. \times 4.00 \times 400 units	Rs. 12,800
Deptt. 2 — 5 hrs. \times 5.00 \times 400 units	<u>10,000</u>
	<u>22,800</u>

Labour Rate Variance : $L_1 - L_2$

Deptt. 1 = Rs. 11,800 - Rs. 12,000	Rs. 200 (F)
Deptt. 2 = Rs. 13,250 - Rs. 12,000	<u>1,250 (A)</u>
	<u>1,050 (A)</u>

Labour Efficiency Variance $L_2 - L_5$

Deptt. 1 = Rs. 12,000 - Rs. 12,800	Rs. 800 (F)
Deptt. 2 = Rs. 12,000 - Rs. 10,000	<u>2,000 (A)</u>
	<u>1,200 (A)</u>

(c) Material

A—Price	(F) Supplier's price reduction
B—Price	(A) Policy change to depend on a more reliable supplier
A—Usage	(A) Lower price paid accompanied by reduction in quality
B—Usage	(F) Better training of production workers

Labour

Deptt. 1—Rate	(F) Mix of employees used shifts towards lower skill/rate of pay grades.
Deptt. 2—Rate	(A) Wage increase awarded was greater than that anticipated by the standard setters.

Deptt. 1—Efficiency (A) More intensive machine maintenance programme resulting in lower breakdown.

Deptt. 2—Efficiency (A) Overtime working causes greater fatigue and more mistakes are made.

• (d) (i) *Production Volume Ratio or Activity Ratio*

$$= \frac{\text{Actual Output in standard hours}}{\text{Budgeted output in standard hours}} \times 100$$

$$\text{Deptt. 1} = \frac{400 \times 8}{3,400} \times 100 = 94.12\%$$

$$\text{Deptt. 2} = \frac{400 \times 5}{2,600} \times 100 = 76.92\%$$

$$(ii) \text{ Efficiency Ratio} = \frac{\text{Output in standard hours}}{\text{Actual hours worked for producing that output}} \times 100$$

$$\text{Deptt. 1} = \frac{400 \times 8}{3,000} \times 100 = 106.67\%$$

$$\text{Deptt. 2} = \frac{400 \times 5}{2,400} \times 100 = 83.33\%$$

Problem 138. (Cost-Volume-Profit Analysis). The owners of a chain of retail petrol filling stations are considering opening an additional station. Initially, one grade of petrol only would be sold and the normal selling price would be Rs. 4.40 per litre. Variable charges—cost of petrol, delivery and Excise Duty—total Rs. 4.00 per litre.

The fixed costs for a 4-week period are estimated to be :

Rent	Rs. 2,000
Rates on business premises	1,000
Wage- 5 people on shifts	3,000
Wage-related costs	400
Electricity for continuous opening (24-hour)	300
Other fixed costs	110

Throughout this question, tax is ignored.

You are required :

1. to calculate the breakeven point in number of litres and also in rupees, for a four-week period if :

- the above costs applied,
- the rent was increased by 75%,
- the rent remained at Rs. 2,000 but commission of Re. 0.02 was given to the employees as a group bonus for every litre sold,
- the selling price was reduced to Rs. 4.30 and no commission was paid (with the rent at Rs. 2,000);

2. to state how many litres would need to be sold per four-week period at Rs. 4.40 if costs were as in the original data (that is; with rent at Rs. 2,000) to achieve a profit of Rs. 700 per week;

3. to advise the management about the following proposals, assuming sales for a four-week period at a price of Rs. 4.50 per litre are normally

(ii) 27,500 litres, and

(ii) 42,500 litres

The possibility of operating from 07-00 to 23-00 hours is being considered. The total savings for a four-week period on the original data would be Rs. 120 for electricity and one night-shift person paid Rs. 200 per week (wage-related costs Rs. 25 per week) would no longer be required. Sales would, however, be reduced by 5,000 litres over a four-week period.

Working should be shown.

Solution : 1 (i) Contribution per litre Rs. 4.40 4.00 = Re. 0.40

Fixed cost = Rs. 6,810

B.F. Point = Rs 6,810 ÷ 0.40 = 17,025 litres

$$\text{B.E. Sales} = 17,025 \text{ litres} \times \text{Rs. } 4.40 = \text{Rs. } 74,910$$

(ii) Existing Fixed Cost = Rs. 6,810

Add 75% increase in rent	1,500
--------------------------	-------

Revised fixed cost	8,310
--------------------	-------

$$\text{B.E. Point Rs. } 8,310 \div 0.40 = 20,775 \text{ litres}$$
$$\text{B.E. Sales} = 20,775 \times \text{Rs. } 4.40 = \text{Rs. } 91,410$$

(iii) Fixed cost = Rs. 6,810

Reduction in contribution due to

$$\text{extra commission} = \text{Rs. } 0.40 - 0.02 = \text{Rs. } 0.38$$
$$\text{B.E. Point} = \text{Rs. } 6.810 : 0.38 = 17.921 \text{ litres}$$
$$\text{B.E. Sales} = 17.921 \times 4.40 = \text{Rs. } 78,852$$

(iv) Revised contribution = Rs. 4.30 – Rs. 4.00 = Re. 0.30

Fixed cost = Rs. 6,810

B.E. Point = Rs. 6,810 ÷ 0.30 = 22,700 litres

B.E. Sales = 22,700 × 4.30 = Rs. 97,610

2. Profit per week = Rs. 700

Profit for 4-week period = Rs. 2,800

Fixed cost	6,810
------------	-------

Total contribution	9.610
--------------------	-------

$$\text{Desired Sales (litres)} = \text{Rs. } 9,610 \div 0.40 = 24,025$$

3 (i) Reduced contribution 5,000 litres \times Re. 0.40 Rs. 2,000

Reduced costs :

Electricity	Rs. 120
-------------	---------

Wages	800
-------	-----

Wage related cost	100
-------------------	-----

1.020

Profit reduction from change in hours

3 (ii) The profit reduction would be identical to that above Rs. 980, the volume sold in the four-week period being non-relevant for this

particular decision. In neither case, should the changed hours be introduced.

Problem 139. (Risk Analysis and B.E. Chart). A manufacturer is consider a new product which could be produced in one of two qualities. Standard or De Luxe. The following estimates have been made :

	<i>Standard</i>	<i>De Luxe</i>
Unit labour cost	Rs. 2.00	Rs. 2.50
Unit material cost	1.50	2.00
Unit packaging cost	1.00	2.00
Proposed selling price per unit	7.00	10.00
Budgeted fixed costs per period :		
0—99,999 units	2,00,000	2,50,000
1,00,000 and above	3,50,000	4,00,000

At the proposed selling prices, market research indicates the following demand :

<i>Quantity</i>	<i>Standard</i>	<i>Probability</i>
1,72,000		0.1
1,60,000		0.7
1,48,000		0.2
<i>Quantity</i>	<i>De Luxe</i>	<i>Probability</i>
1,95,500		0.3
1,56,500		0.5
1,09,500		0.2

You are required :

(a) to draw separate breakeven charts for each quality, showing the breakeven points;

(b) to comment on the position shown by the charts and what guidance they provide for management;

(c) to calculate, for each quality, the expected unit sales, expected profits and the margin of safety;

(d) using an appropriate measure of risk, to advise management which quality should be launched.

Solution

(a) *break-even charts are given on next page.*

(b) The *Standard* breakeven chart shows :

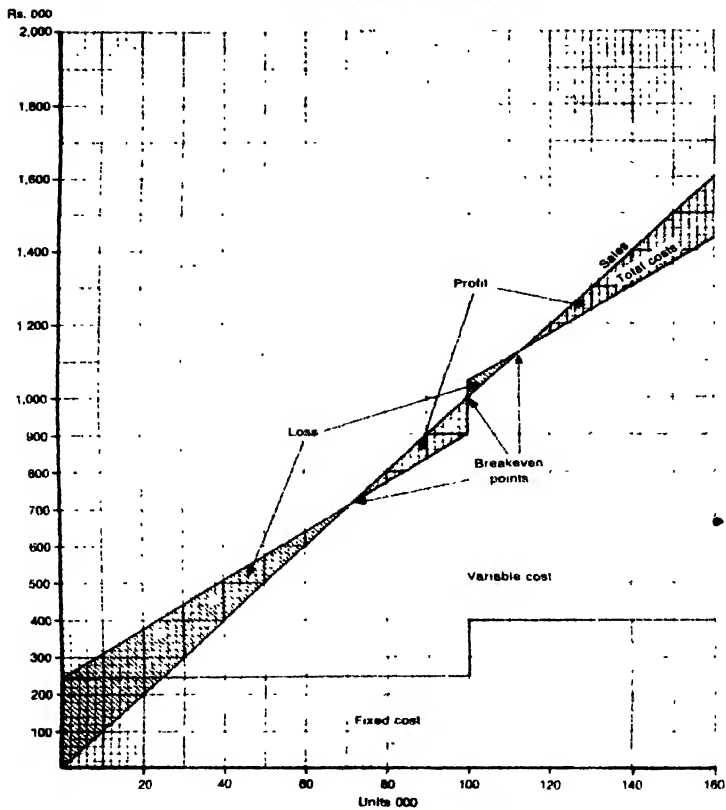
- three breakeven points
- profit being earned on sales from 80,000 to 99,999 units, and above 1,40,000 units
- losses on sales up to 80,000 units and between 1,00,000 and 1,39,999 units

The *De luxe* breakeven points :

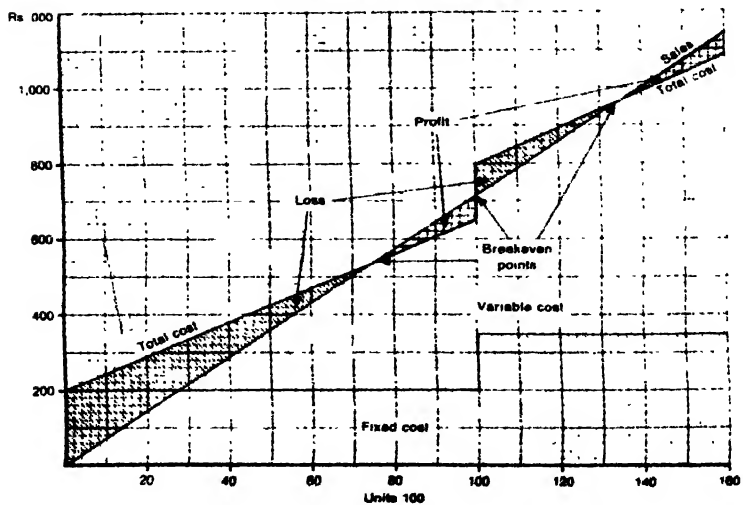
- three breakeven points
- profit being earned on sales from 71,429 to 99,999 units and above 1,14,286 units
- losses on sales up to 71,429 units and between 1,00,000 and 1,14,286 units

Solution (a)

Break-even chart — De luxe quality



Break-even chart — Standard quality



The charts may provide management with guidance regarding the level of sales at which to aim. If drawn to the same scale, product comparisons are facilitated. The charts do not show any measure of the relative risk of the two products.

(c) <i>Standard</i>			<i>Deluxe</i>		
<i>Qty.</i> <i>(units)</i>	<i>Proba-</i> <i>bility</i>	<i>Expected</i> <i>Sales</i>	<i>Qty.</i> <i>(units)</i>	<i>Proba-</i> <i>bility</i>	<i>Expected</i> <i>Sales</i>
1,72,000	0.1	17,200	1,95,500	0.3	58,650
1,60,000	0.7	1,12,000	1,56,500	0.5	78,250
1,48,000	0.2	29,600	1,09,500	0.2	21,900
Expected Sales (Units)		<u>1,58,800</u>			<u>1,58,800</u>
Selling price per unit		Rs. 7.00			Rs. 10.00
Less : Variable costs		<u>4.50</u>			<u>6.50</u>
Contribution per unit		<u>2.50</u>			<u>3.50</u>
Total contribution*		Rs. 3,97,000			Rs. 5,55,800
Less : Fixed cost		<u>3,50,000</u>			<u>4,00,000</u>
Expected profit		<u>47,000</u>			<u>1,55,800</u>
<i>Margin of Safety with highest B.E. Point</i>					
Expected sales		1,58,800			1,58,800
Less : Break-even sales		<u>1,40,000</u>			<u>1,14,286</u>
Margin of Safety (units)		<u>18,800</u>			<u>44,514</u>
S.P. per unit		Rs. <u>7.00</u>			Rs. <u>10.00</u>
Margin of Safety- Value		Rs. <u>1,31,600</u>			Rs. <u>4,45,140</u>

(d) The problem for management is that the Deluxe quality is much more profitable than the Standard, on the basis of expected values but also much more risky. Whilst the expected profit of Deluxe is more than three times that of standard, there is a 0.2 probability of a loss of Rs. 16,750 on the Deluxe whilst the standard shows a profit at all points on the (much smaller) range of sales. The range of sales is 24,000 units for Standard and 86,000 for Deluxe.

Probably the most satisfactory measure of this risk to use is the coefficient of variation :

	<i>Standard</i>	<i>Deluxe</i>
Standard deviation of Sales σ	6,462	29,880
Coefficient of variation σ	6,462	29,880
Expected value of sales \bar{x}	1,58,800	1,58,800
Probability	$\frac{6,562}{1,58,800} = 0.04$	$\frac{29,880}{1,58,800} = 0.188$

In relative terms, the Deluxe product is nearly five times as risky. However, whilst the risk; and especially the risk of making a loss, might be the main influence on the decision making in a small firm with very limited resources, in

* Expected sales \times contribution per unit

a large and diversified firm, the three times greater expected profit on the Deluxe product would determine the decision.

Problem 140. (Budgeted Profit and Loss Account and Cash Budget). The LMN company is preparing budgets for the first quarter of 1991. The company has a single product, the details of which are :

<i>Budgeted variable costs per unit</i>	
Materials	Rs. 12
Labour (4 hour at Rs. 6)	24
Production overhead	8
Selling price per unit	90

Administration overhead is Rs. 23,000 per month and the fixed production overhead is Rs. 15,000 per month, including Rs. 3,500 depreciation.

The factory has a normal capacity of 1,500 units per month. Finished goods stocks are valued at full actual production cost and budgeted opening stocks at 1st January 1991 is 1,200 units valued at Rs. 66,500. It is company's policy to keep finished stock at a constant ratio to the budgeted unit sales of the following month. Extra production over 1,500 units per month can be achieved by working overtime which means paying labour double time for the overtime.

<i>Expected sales</i>	<i>Units</i>
December 1990	1,300
January 1991	1,000
February 1991	1,400
March 1991	1,600
April 1991	1,800
May 1991	1,550

Materials are paid for in the month following delivery and enough stock is kept to cover the next month's budgeted production. Sales are on credit with 30% of debts collected in the month of sale and 67% in the following month, the balance being bad debts. All other costs are paid for in the month they are incurred and no capital expenditure is expected.

You are required :

- to prepare a single budgeted profit and loss account for the quarter (January, February, March) ;
- to prepare cash budgets for each month of the quarter;
- to reconcile the net cash movement for the quarter to the budgeted profit.

Solution. (a) Before budgeted profit and loss account for quarter ending 31st March 1991 is prepared, the following quantitative computations have to be shown :

<i>Month</i>	<i>(Units)</i>				
	<i>Jan.</i>	<i>Feb.</i>	<i>March</i>	<i>April</i>	<i>Quarter ended 31st March</i>
Expected sales	<u>1,000</u>	<u>1,400</u>	<u>1,600</u>	<u>1,800</u>	<u>4,000</u>

Actual required op. stock

(ratio to expected

sales 1-2)*

	1,200	1,680	1,920	2,160 [†]	1,200
Closing stock	<u>1,680</u>	<u>1,920</u>	<u>2,160</u>		<u>2,160</u>
Stock increase	480	240	240		960
Production = Sales +					
Stock increase	1,480	1,640	1,840		4,960
Overtime production	—	<u>140</u>	<u>340</u>		
(stockincrease - 1,500)		480			

Budgeted profit and loss account for quarter to 31st March 1991

Sales (4,000 units × Rs. 90)	Rs. 3,60,000
Less : Cost of sales	
Opening stock (1,200 units) (Given)	Rs. 66,500
Add : Production costs (4,960 units)	
Material	Rs. 12
Normal labour	24
Variable overhead	<u>8</u>
Total	<u>44</u>
	Rs. 44 × 4,960 = Rs. 2,18,240
Overtime Rs. 24 × 480	= 11,520
Fixed production overhead	<u>45,000</u>
Gross profit	<u>2,74,760</u>
Less closing stock (2,74,760 + 4,960) × 2,160	<u>1,19,654[@]</u>
	<u>1,38,394</u>
Less : Administrative overheads	69,000
Bad debts	<u>10,800</u>
Net profit	<u>58,594</u>

(b)

Data for Cash Budget

	Dec.	Jan.	Feb.	March	April
Sales units	1,300	1,000	1,400	1,600	1,800
Production	940	1,480	1,640	1,840	1,500
Material usage @ Rs. 12 (Rs.)	17,760	17,760	19,680	22,080	
Purchases (Rs.)	17,760	19,680	22,080	18,000	
Sales (Rs.)	1,17,000	90,000	1,26,000	1,44,000	1,62,000

Cash Budget

(In Rupees)

Receipts	Jan	Feb.	March	Quarter
Current sales (30%)	27,000	37,800	43,200	
Previous month (67%)	<u>78,390</u>	<u>60,300</u>	<u>84,420</u>	

* This ratio remains constant for all the months.

† First findout opening stock for all months at the ratio of 1-2 and this figure will become the closing stock of previous month.

@ Please note the treatment of closing stock valuation.

	<u>1,05,390</u>	<u>98,100</u>	<u>1,27,620</u>	<u>3,31,110</u>
Payments				
Materials	17,760	19,680	22,080	
Labour (normal) @ Rs. 24	35,520	39,360	44,160	
Labour (overtime)	—	3,360	8,160	
Variable overhead	11,840	13,120	14,720	
Fixed overhead (less depr.)	11,500	11,500	11,500	
Administration overhead	<u>23,000</u>	<u>23,000</u>	<u>23,000</u>	
	<u>99,620</u>	<u>1,10,020</u>	<u>1,23,620</u>	<u>3,33,260</u>
Net Cash Flow	5,770	(11,920)	4,000	(2,150)
(c) Reconciliation				
Budgeted profit				Rs. 58,594
Add : Depreciation				<u>10,500</u>
Less : Increase in finished stock	1,19,654			69,094
	<u>66,500</u>			(-)53,154
Increase in debtors	96,480			
	<u>78,390</u>			(-)18,090
Net Cash flow				<u>2,150</u>

Notes. 1. Raw materials stocks and creditors cancel out.

2. Alternative methods of valuing stock are possible and will give slightly different results.

Problem 141. (Learning Curve Application and Capital Investment Decision). RS p.l.c. manufactures domestic food mixers. It is investigating whether or not to accept a three-year contract to make a new model for sale through a supermarket chain. The contract uses skilled labour which cannot be increased above that currently available and RS p.l.c. will receive a fixed price of Rs. 42 per mixer for all the mixers it can produce in the three-year period. The following estimates have been made :

Capital investment	Rs. 50,000 payable now, with nil scrap value.
Additional overhead	Rs. 25,000 per annum.
Materials	Rs. 30 per mixer.
Labour	Rs. 6 per hour.

The factory manager knows from experience of similar machines that there will be a learning effect for labour. He estimates that this will take the form :

$$y = ax^{0.3}$$

where y = average labour hours per unit
 a = labour hours for first unit
 x = cumulative production

He estimates that the first mixer will take 10 hours to produce and that the fixed amount of labour available will enable 5,000 mixers to be produced in the first year.

Apart from the capital investment, all cash flows can be assumed to arise at year ends.

The company has a cost of capital of 15%.

You are required to calculate the NPV of the proposed contract.

Solution : Working to find out labour hours and units

Year 1 $y = ax^b$

$$\begin{aligned}\text{Average hours per unit : } y (5000) &= 10 \times 5,000^{-0.3} \\ &= \log 10 - 0.3 (\log 5000) \\ &= 1 - 0.3 (3.699) = 1 - 1.1097 \\ &= -0.1097 \text{ or } 1 - 0.01097 = 0.8903 \\ \text{Antilog of } 0.8903 &= 0.7768\end{aligned}$$

$$\text{Total hours per annum} = 5,000 \times 0.7768 = \underline{\underline{3,884}}$$

Year 2

To find out put in cumulative : $2 \times 3,884 = 7,768$ hours

$$y = ax^b$$

For this purpose introduce Y = total number of hours

$$\begin{aligned}\frac{Y}{x} &= y ; & \text{Then } y &= ax^b \\ \frac{Y}{x} &= ax^b & \text{or } Y &= ax^{b+1} \\ 7,768 &= 10x^{0.7} & \text{or } x^{0.7} &= 776.8\end{aligned}$$

$$0.7 \log x = \log 7,768 \quad \text{or} \quad \log x = \frac{2.8903}{0.7} = 4.129$$

Antilog of 4.129 = 13,460

$$13,460 - 5,000 = \underline{\underline{8,460}} \text{ hours in year 2}$$

Year 3 Hours available $= 3 \times 3,884 = 11,652$

$$Y = ax^{b+1} = 11,652 = 10x^{0.7}$$

$$\text{or } 0.7 \log x = 1165.2 = \log x = \frac{3.0663}{0.7} = 4.3805$$

Antilog of 4.3806 = 24,020

$$24,020 - 13,460 = \underline{\underline{10,560}} \text{ hours in year 3}$$

Statement showing Net Present Value during 3 years

Year	1	2	3
Output	5,000	8,460	10,560
Sales @ Rs. 42	Rs. <u>2,10,000</u>	<u>3,55,320</u>	<u>4,43,520</u>
Less : Costs			
Labour (3884 × Rs. 6)	23,304	23,304	23,304
Material @ Rs. 30	1,50,000	2,53,800	3,16,800
Overheads	<u>25,000</u>	<u>25,000</u>	<u>25,000</u>
Total costs	<u>1,98,304</u>	<u>3,02,104</u>	<u>3,65,104</u>
Net cash flow	<u>11,696</u>	<u>53,216</u>	<u>78,416</u>
Discount factor	0.87	0.76	0.66
Present Values	<u>10,176</u>	<u>40,444</u>	<u>51,755</u>

Rs. 1,02,374

Less Initial capital investment

50,000

Net Present Value

52,374

The project should be accepted.

Problem 142. (Combined Analysis of fixed and variable Overhead Variances). The following budget was prepared for the overhead of Department X :

<i>Budget for period</i>	
Fixed overhead	Rs. 5,600
Variable overhead	Rs. 10,400
Machine hours	1,600
Standard hours of production	1,600
After the period the <i>actual results</i> were :	
Total overhead	Rs. 17,400
Machine hours	1,630
Standard hours produced	1,590

You are required to calculate the overhead variances for the period.

Solution : Application rates :

Fixed overhead = Rs. 5,600 ÷ 1,600 hrs = Rs. 3.50 per hour.

Variable overhead = Rs. 10,400 ÷ 1,600 hrs = Rs. 6.50 per hour

Total overhead rate = Rs. 3.50 + Rs. 6.50 = Rs. 10.00

For Calculation of overhead variance

Note : Both fixed overhead variances and variable overhead variances will be calculated together, because break-up of "overhead incurred" into fixed and variable overhead is not given.

FO ₁ & VO ₁ — Actual overhead incurred	Rs. 17,400	
FO ₂ & VO ₂ — FO ₂ — Budgeted Fixed Overhead	5,600	
VO ₂ — Actual hours worked at standard variable overhead rate 1,630 hrs × Rs. 6.50	<u>10,595</u>	16,195
FO ₃ — Not applicable, because there is no Idle time/Calendar variance		
*FO ₄ & VO ₃ Actual hours worked at standard overhead rate		
1,630 × Rs. 3.50	= Rs. 5,705	
1,630 × Rs. 6.50	<u>10,595</u>	16,300
*FO ₅ & VO ₃ — Standard overhead for production		
Fixed — 1,590 hrs × Rs. 3.50	= Rs. 5,565	
Variable 1,590 hrs × Rs. 6.50	= <u>10,335</u>	15,900

Overhead Expenditure Variance = FO₁ – FO₂ & VO₁ – VO₂

= Rs. 17,400 – Rs. 16,195 = Rs. 1,205 (A)

Overhead Calendar or Idle time variance = Nil (∵ FO₃ has no value)

Overhead Capacity Variance = FO₃ – FO₄

= Rs. 16,195 – Rs. 16,300 = Rs. 105 (F)

* Since FO₃ is nil, value of preceding step has been taken

Overhead Efficiency Variance = FO₄ – FO₅

= Rs. 16,300 – Rs. 15,900 = 400 (A)

***Overhead Volume Variance** = FO₂ – FO₅

= Rs. 16,195 – 15,900 = 295 (A)

Overhead Variance = FO₁ – FO₅

= Rs. 17,400 – Rs. 15,900 = Rs. 1,500 (A)

* Then VO₃ is the last step, but in this question VO₃ has been clubbed with FO₄ because total overhead variance have to be found out.

Problem 143. (Probability Applications to Stock Levels). DB p.l.c. operates a conventional stock control system based on re-order levels and Economic Ordering Quantities. The various control levels were set originally based on estimates which did not allow for any uncertainty and this has caused difficulties because, in practice, lead times, demands and other factors do vary.

As part of a review of the system, a typical stock item, Part No. X206, has been studied in detail as follows :

Data for Part No. X206

<i>Lead times</i>	<i>Probability</i>
15 working days	0.2
20 working days	0.5
25 working days	0.3
<i>Demand per working day</i>	<i>Probability</i>
5,000 units	0.5
7,000 units	0.5

Note : It can be assumed that the demands would apply for the whole of the appropriate lead time.

DB p.l.c. works for 240 days per year and it costs Re. 0.15 p.a. to carry a unit of X206 in stock. The re-order level for this part is currently 1,50,000 units and the re-order cost is Rs. 1,000.

You are required :

- to calculate the level of buffer stock implicit in a re-order level of 1,50,000 units;
- to calculate the probability of a stock-out;
- to calculate the expected annual stock-outs in units;
- to calculate the stock-out cost per unit at which it would be worthwhile raising the re-order level to 1,75,000 units;

Solution

(a) Lead time \times total demand in lead time \times Joint probability = Expected value.

15 \times 5,000	75,000	0.2 \times 0.5 = 0.1	7,500
15 \times 7,000	1,05,000	0.2 \times 0.5 = 0.1	10,500
20 \times 5,000	1,00,000	0.5 \times 0.5 = 0.25	25,000
20 \times 7,000	1,40,000	0.5 \times 0.5 = 0.25	35,000
25 \times 5,000	1,25,000	0.3 \times 0.5 = 0.15	18,750
25 \times 7,000	1,75,000	0.3 \times 0.5 = 0.15	26,250
		1.00	1,23,000

Expected value of demand in lead time = Rs. 1,23,000

Buffer stock = 1,50,000 - 1,23,000 = 27,000 units

(b) P (Stockout) = P (Demand > 1,50,000) = 0.15 [from table (a) above]

(c) $EOQ = \sqrt{\frac{2 \times (6,000 \times 240) \times 1,000}{0.15}} = 1,38,564$ units

$$\text{Orders per annum} = \frac{6,000 \times 240}{1,38,564} = 10.39 \text{ on an average}$$

$$\therefore \text{Expected stockout per annum} = 0.15 (1,75,000 - 1,50,000) \times 10.39 \\ = 38,962 \text{ units}$$

(d) At 1,50,000 re-order level, stockout is = 38,962 units

At 1,75,000 re-order level, stock-out is nil

Additional cost = $25,000 \times 0.15$ = Rs. 3,750

\therefore Unit cost at which increased stock is justified

$$= \frac{3,750}{38,962} = \text{Re. } 0.096 \text{ or } 9.6 \text{ paise per unit.}$$

Problem 144. (Capital Investment Analysis). In the manufacture of a company's range of products, the processes give rise to two main types of waste material.

Type A is the outcome of the company's original processes. This wastage is sold at Rs. 2 per tonne, but this amount is treated as sundry income and no allowance for this is made in calculating product costs.

Type B is the outcome of newer processes in the company's manufacturing activity. It is classified as hazardous, has needed one employee costing Rs. 9,000 per year specially employed to organise its handling in the factory, and has required special containers whose current resale value is assessed at Rs. 18,000. At present the company pays a contractor Rs. 14 per tonne for its collection and disposal.

Company management has been concerned with both types of waste and after much research has developed the following proposals.

Type A waste

This could be further processed by installing plant and equipment costing Rs. 20,000 and incurring extra direct costs of Rs. 2.50 per tonne and extra fixed costs of Rs. 10,000 per annum.

Extra space would be needed, but this could be obtained by taking up some of the space currently used as a free car park for employees. The apportioned rental cost of that land is Rs. 2,500 per annum and a 'compensation' payment totalling Rs. 500 per annum would need to be paid to those employees who would lose their car-parking facilities.

The selling price of the processed waste would be Rs. 12.50 per tonne and the quantity available would be 2,000 tonnes per annum.

Type B waste

Using brand-new technology, this could be further processed into a non-hazardous product by installing a plant costing Rs. 1,20,000 on existing factory space whose apportioned rental cost is Rs. 12,500 per annum.

This plant cost includes a pipeline that would eliminate any special handling of the hazardous waste. Extra direct costs would be Rs. 13.50 per tonne and extra fixed costs of Rs. 20,000 per annum would be incurred.

This new product would be saleable to a limited number of customers only, but the company has been able to get the option of a contract for two years' sales renewable for a further two years. This would be at a price of Rs. 11 per tonne and the output over the next few years is expected to be 4,000 tonnes per year.

For Type A waste project, the board wants to achieve an 8% DCF return over four years. For Type B waste project, it wants a 15% DCF return over six years.

You are required to recommend whether the company should invest in either or both of the two projects.

Give supporting figures and comments.

Assume that no capital rationing exists.

Ignore inflation and taxation.

P.V. of an annuity for four years @ 8% is 3.31 and P.V. of an annuity for six years @ 15% is 3.78.

Solution : Project Appraisal of the two proposals.

Type A Waste :

Capital investment	<u>Rs 20,000</u>
<i>Annual costs :</i>	
Direct costs (2,000 tonnes × Rs. 2.50)	5,000
Extra fixed costs	10,000
Car parking compensation	<u>500</u>
Total	<u>15,500</u>
Increased sales income	
2,000 tonnes × (Rs. 12.50 – Rs. 2)	<u>21,000</u>
Extra annual income (Rs. 21,000 – 15,500)	<u><u>5,500</u></u>

Year	Cash flow	Discount factor	Present value
0	(Rs. 20,000)	1.00	(Rs. 20,000)
1-4	RS 5,500	3.31	<u>18,205</u>
	Negative NPV		<u><u>(1,795)</u></u>

Recommendations : This project should not be accepted. It produces a negative return even when the present apportioned cost of land is ignored.

Type B Waste

Capital investment	Rs. 1,20,000
Less : Sale of redundant containers	<u>18,000</u>
Net investment	<u><u>1,02,000</u></u>

Annual incremental cashflow :

Sales income (4,000 tonnes × Rs. 11)		44,000
Saving an existing operations :		
Contractors costs 4,000 × Rs. 14 =	56,000	
Employee costs	<u>9,000</u>	<u>65,000</u>
Total		<u><u>1,09,000</u></u>

Less : Additional costs of new operation :

Direct costs 4,000 tonnes \times Rs. 13.50 =	54,000	
Fixed costs	<u>20,000</u>	<u>74,000</u>
Net annual cash in flow		<u>35,000</u>

If the contract lasts for six years

Years	Cash flow	Discount factor at 15%	Present value
0	(1,02,000)	1.00	(1,02,000)
1-6	35,000	3.78	<u>1,32,300</u>
	Positive NPV		<u>30,300</u>

If contract only lasts four year

Calculation as above Rs. 30,300

Loss of income for years 5 and 6

(4,000 tonnes \times Rs. 11) \times 0.92 (40,480)

Negative NPV (10,180)

This will be increased by any disposal costs of the unwanted products or reduced if they could be disposed of profitably for some other purpose.

Recommendation : The project should be accepted if the contract lasts for six years. Further removal of hazardous material is obligatory on the part of the company.

Problem 145. (Transfer Pricing). *L Ltd.* and *M Ltd.* are subsidiaries of the same group of companies.

L Ltd. produces a branded product sold in drums (10,000 in number) at a price of Rs. 20 per drum.

Its direct product costs *per drum* are :

—Raw material from *M Ltd.* At a transfer price of Rs. 9 for 25 litres.

—Other products and services from outside the group : At a cost of Rs. 3.

L Ltd.'s fixed costs are Rs. 40,000 per month. These costs include process labour whose costs will not alter until *L Ltd.*'s output reaches twice its present level.

A market research study has indicated that *L Ltd.*'s market could increase by 80% in volume if it were to reduce its price by 20%.

M Ltd. produces a fairly basic product which can be converted into a wide range of end products. It sells one third of its output to *L Ltd.* and the remainder to customers outside the group.

M Ltd.'s production capacity is 1,000 kilolitres per month, but competition is keen and it budgets to sell no more than 750 kilolitres per month for the year ending 31st December 1990.

Its variable costs are Rs. 200 per kilolitre and its fixed costs are Rs. 60,000 per month.

The current policy of the group is to use market prices, where known, as the transfer price between its subsidiaries. This is the basis of the transfer price between *M Ltd.* and *L Ltd.*

Your are required

(a) to calculate the monthly profit position for each of *L Ltd* and *M Ltd* if the sales of *L Ltd* are :

- (i) at their present level, and
 - (ii) at the higher potential level indicated by the market research, subject to a cut in price of 20%.
- (b) to explain why the use of a market price as the transfer price produces difficulties under the conditions outlined in (a) (ii) above;
- (c) to recommend, with supporting calculations, what transfer prices you would propose.

Solution (a) (i) Monthly profit position of *L Ltd.* at the present sales level.

		Rs. '000
Sales 10,000 drums @ 20 per drum		200
Less : Direct costs	Rs. '000	
Raw materials (10,000 × Rs. 9)	90	
Other expenses (10,000 × Rs. 3)	<u>30</u>	<u>120</u>
Contribution		80
Less : Fixed costs		<u>40</u>
Profit		<u>40</u>

Monthly profit position of *M Ltd.* at the present sales level

Sales (7,50,000 litres @ Rs. 9 for 25 litres)	270
Less : Variable costs (200/1000) × 7,50,000	<u>150</u>
Contribution	120
Less : Fixed costs	<u>60</u>
Net profit	<u>60</u>

(ii) Monthly profit position of *L Ltd.* at the higher sales level

		Rs. '000
Sales (with 80% increase in volume with 20% reduction in price)		
18,000 drums × Rs. 20		288
Less : Direct costs :		
	Rs. '000	
Raw materials 18,000 × Rs. 9	162	
Other expenses 18,000 × 3	<u>54</u>	<u>216</u>
Contribution		72
Less : Fixed costs		<u>40</u>
Net profit		<u>32</u>

Monthly profit position of M. Ltd. at the higher sales level

Sales (9,50,000* litres @ Rs. 9 for 25 litres)	342
Less : Variable costs	<u>190</u>
Contribution	152
Less : Fixed costs	<u>60</u>
Net Profit	<u>92</u>

(b) **Market price as the basis of Transfer Pricing :** Market price is the most satisfactory basis for inter company transfer prices as it avoids an extensive arbitration system. However, in this case the affect of L. Ltd. increasing its sales by 80% is to reduce its profit by Rs. 8,000 and increase M. Ltd. profit by Rs. 32,000. Therefore, there is no incentive for L. Ltd. to take on extra business. There is a drop in L. Ltd profit by 20%. Increase in overall profit is : (Rs. 92,000 + Rs. 32,000) - (Rs. 60,000 + Rs. 40,000) = Rs. 24,000 i.e. 24% increase in profit. Thus, there will be no goal congruence between L. Ltd and the Group.

(c) **Proposed Transfer Price :** For L. Ltd. to maintain its current sales profit margin, it would need to increase profit to $(Rs. 288/200) \times Rs. 40,000 = Rs. 57,600$. This would take Rs. 17,600 of the group extra profit of Rs. 24,000 and this may not be acceptable to M. Ltd. The existing division of profit is Rs. 40,000 : Rs. 60,000. Sharing the extra Rs. 24,000 in this ratio would give L. Ltd. Rs. 9,600 and M. Ltd. Rs. 14,400.

If the price of M. Ltd. on the extra volume is reduced by 25% from Rs. 9 per 25 litres to Rs. 6.75 per 25 litres. This would reduce L. Ltd costs by Rs. 18,000. It would transform the Rs. 8,000 reduction in profit to an increase of Rs. 10,000. This is then in line with existing profit level. The 25% reduction should be justified by calculations based on the suggestions at (b)

Recommendations : L. Ltd. should be charged at Rs. 6.75 per 25 litres on the extra volume based on the market price of Rs. 9 less 25% justified as indicated.

Problem 146. (Probability Application to decision involving overtime working vs. sub-contracting). A design consultancy company employs the following staff whose work can be charged to its clients :

Types of staff	Number of staff	Budgeted annual salary per person	Setting price multiple of salary costs
Designers	4	Rs. 30,000	2.1 times
Draughtsmen	12	Rs. 15,000	1.6 times

Work for clients is done in teams whose ratio of draughtsmen to designers is 3 to 1. It does not matter which individual designers or draughtsmen constitute a team.

* Existing production 7,50,000 litres (2,50,000 supplied to L. Ltd and 5,00,000 supplied to outside parties) Revised production 5,00,000 litres + 2,50,000 litres $\times 1.8 = 9,50,000$ litres

For budgeting purposes the year is split into 12 months each of 20 working days ; except for salaries and any overtime, all costs are treated as fixed. Both designers and draughtsmen are available to work overtime at a premium of 40% of their salary rate.

The company has a long-standing arrangement whereby it can sub-contract draughtsmen it does not require to an associate organisation which will pay to the company the draughtsmen's salaries plus 20%.

However, draughtsmen can only be sub-contracted in pairs and for a full month. Notice of intention to sub-contract for any month must be given by the fifteenth day of the preceding month.

On the fourteenth day of month 7, the company's order book for month 8 shows :

	<i>Agreed (or quoted) selling price of orders</i>	<i>Probability of obtaining the order</i>
Confirmed order	Rs. 25,200	1.0
Unconfirmed orders :		
Customer reference		
B 411	6,200	0.6
E 286	3,700	0.9
G 347	11,100	0.4
K 127	5,400	0.8
P 744	8,300	0.5
S 502	6,800	0.4
V 218	5,500	0.7

You are required, in respect of month 8,

- (a) to explain by what rule you would determine whether to use overtime and/or whether to sub-contract draughtsmen to the associate organisation;
- (b) to calculate the gross profit for the company if the level of orders achieved were :
 - (i) all confirmed orders, only
 - (ii) all confirmed orders plus the expected value of all unconfirmed orders.

Assume that, for each level of orders, the method used (i.e. whether or not to sub-contract draughtsmen and/or to use overtime) is the one that would yield the highest profit ;

Solution : Working Notes

Expected values of all orders			
<i>Nature of order</i>	<i>Selling price of the order</i>	<i>Probability</i>	<i>Expected Values</i>
Confirmed	Rs. <u>25,200</u>	1.0	Rs. <u>25,200</u>
Unconfirmed	6,200	0.6	3,720
	3,700	0.9	3,330

	11,100	0.4	4,440
	5,400	0.8	4,320
	8,300	0.5	4,150
	6,800	0.4	2,720
	<u>5,500</u>	0.7	<u>3,850</u>
	<u>47,000</u>		<u>26,530</u>
Total	<u>72,200</u>		<u>51,750</u>

Statement showing costs, profit and selling price of a team for one day

	Number	Salary per annum Rs.	Total annual salary Rs.	Salary per day	Selling price multiple of	Selling price Rs.	Profit Rs.
Designer	1	30,000	30,000	Rs. 125*	2.1 times	262.50	137.50
Draftsmen	3	15,000	<u>45,000</u>	<u>187.50</u>	1.6 times	<u>300.00</u>	<u>112.50</u>
			<u>75,000</u>	<u>312.50</u>		<u>562.50</u>	<u>250.00</u>

Team days available per month = $20 \times 4 = 80$.

Cost per team per day for overtime = 140% of Rs. 312.50 = Rs. 437

Sub-contracting two draughtsmen for a month at Rs. 125 per day + 20%

i.e., Rs. 150 per day for 20 working days = Rs. 3,000

Therefore, the number of days, it is profitable to work overtime in lieu of sub-contracting draughtsmen = $\text{Rs. } 3,000 \div 437 = 6.9$ or 7 days

(a) From the above workings, it is clear if *less than seven* days overtime results from sub-contracting two draughtsmen, then sub-contracting is preferred. For more than seven days, it is preferred to use overtime.

(b) *Gross profit from confirmed orders only*

Number of sales days = Expected value (confirmed) \div Selling price =
 $\text{Rs. } 25,200 \div 562.50 = 45$ days

Capacity available in term of team days = 80 days

Idle days = $80 - 45 = 35$ days.

Available days for 6 draughtsmen = $(80 \text{ days} + 12) \times 6 = 40$ days

No. of days overtime $45 - 40 = 5$ days.

Five days overtime, being below seven days economic level is quite acceptable.

Income from confirmed orders Rs. 25,200

Sub-contracting 6 draughtsman ($\text{Rs. } 150 \times 3 \times 20$) 9,000

Total income 34,200

Less : Cost

80 days @ Rs. 312 = Rs. 24,960

5 days @ Rs. 437 = 2,185

Gross profit 27,145

7,055

* $\text{Rs. } 30,000 \div (12 \text{ months} \times 20 \text{ days}) = \text{Rs. } 125$.

(ii) *Gross profit from confirmed orders plus unconfirmed orders.*

Number of Sales days = Total expected value ÷ Selling price

$$= \text{Rs. } 51,730 \div 562.50 = 92 \text{ days.}$$

Capacity available = 80 days

Overtime days = 12 days

Income from both types of orders = Rs. 51,730

Less : Cost

$$80 \text{ days} \times \text{Rs. } 312 = \text{Rs. } 24,960$$

$$12 \text{ days} \times \text{Rs. } 437 = \underline{\underline{5,244}} \quad \underline{\underline{30,204}}$$

Gross profit 21,526**Problem 147. (Own Service Centres vs. Local Sub-contractors).**

A company producing and selling a range of consumer durable appliances has its after-sales service work done by local approved sub-contractors.

The company is now considering carrying out all or some of the work itself and it has chosen one area in which to experiment with the new routine.

Some of the appliances are so large and bulky that repair/service work can only be done at the customers' homes. Others are small enough for sub-contractors to take them back to their local repair workshops, repair them, and re-deliver them to the customer. If the company does its own after-sales service, it proposes that customers would bring these smaller items for repair to a local company service centre which would be located and organised to deal with visitors.

There is a list price to customers for the labour content of any work done and for materials used. However, the majority of the after-sales service work is done under an annual maintenance contract taken out by customers on purchasing the product; this covers that labour content of any service work to be done, but customers pay for materials used.

Any labour or materials needed in the first six months are provided to the customer free of charge under the company's product guarantee and sub-contractors are allowed by the company a fixed sum of 3.5% of the selling price for each appliance to cover this work. These sums allowed have proved closely in line with the work needed over the past few years.

The price structure is -

For materials :

Price to sub-contractor : Company cost plus 10%

Price to customer : Sub-contractor's price plus 25%

For labour : Price to sub-contractor :

Work done under maintenance contract : 90% of list price

Ad hoc work (i.e. work NOT done under maintenance contract) : 85% of list price

Records show that 60% by value of the work has to be carried out at customers' homes, whilst the remainder can be done anywhere appropriate.

The annual income that the company currently receives from sub-contractors for the area in which the experiment is to take place is :

Labour	—under maintenance contract	Rs. 30,000
	— ad hoc	12,000
Materials	— under maintenance contract	18,000
	— ad hoc	<u>6,000</u>
		<u>66,000</u>

The company expects the volume of after-sales work to remain the same as last year for the period of the experiment.

The company is considering the following options :

1. Set up a local service centre at which it can service small appliances only.
Work at customers' houses would continue to be done under sub-contract.
2. Set up a local service centre to act only as a base for its own employees who would only service appliances at customers' homes.
Servicing of small appliances would continue to be done under sub-contract.
3. Set up a local combined service centre plus base for all work.
No work would be sub-contracted.

If the company were to do service work, annual fixed costs are budgeted to be :

	Option 1 Rs. '000	Option 2 Rs. '000	Option 3 Rs. '000
Establishment costs (rent, rates, light, etc.)	40	15	45
Management costs	20	15	30
Storage staff costs	10	10	15
Transport costs (all vans/cars hired)	8	65	70
Repair/service staff	70	180	225

You are required to recommend which of the three options the company should adopt from a financial viewpoint.

5. Working : Present business based on income received from subcontractor

Labour—maintenance contract	Customer price
Income Rs. 30,000 = 10% list price = 30,000 ÷ 10%	Rs. 3,00,000
Labour—ad hoc	
Income Rs. 12,000 = 15% of list price = 12,000 ÷ 15	80,000
Materials—maintenance contract	
Income Rs. 18,000 = 10/137.5* list price	† 2,47,500
Materials—ad hoc	
Income Rs. 6,000 = 10/137.5* list price	<u>82,500</u>
	<u><u>7,10,000</u></u>

† Rs. 18,000 ÷ $\frac{10}{137.5}$

***Material price calculation**

Company price	Rs 100
Contractor price + 10%	<u>10</u>
	110
Customer price + 25%	<u>27.5</u>
List price	<u><u>137.5</u></u>

Analysis of business

Large items at customers' homes	60%	Rs. 4,26,000
Small items	40%	<u>2,84,000</u>
		<u><u>7,10,000</u></u>

Option 1

Sales from small items Rs. 2,84,000

Costs

Labour	Rs. 70,000	
Materials		
$40\% \times \frac{100}{137.5} \times (\text{Rs. } 2,47,500 + \text{Rs. } 82,500)$	96,000	
Fixed costs	<u>78,000</u>	<u>2,44,000</u>
Income from own operations		40,000
Income from sub contractor of large items		
60% of Rs. 66,000		<u>39,600</u>
Total income		<u><u>79,600</u></u>

Option 2

Sales from large items Rs. 4,26,000

Costs

Labour	Rs. 1,80,000	
Materials		
$60\% \times \frac{100}{137.5} \times (\text{Rs. } 2,47,500 + \text{Rs. } 82,500)$	1,44,000	
Fixed costs	<u>1,05,000</u>	<u>4,29,000</u>
Direct on own operations		(3,000)
Income from subcontractor of small items		
40% of Rs. 66,000		<u>26,400</u>
Net income		<u><u>23,400</u></u>

Option 3

Sales from large and small items Rs. 7,10,000

Costs

Labour	Rs. 2,25,000	
Materials		
$\frac{100}{137.5} \times (\text{Rs. } 2,47,500 + \text{Rs. } 82,500)$	2,40,000	
Fixed costs	<u>1,60,000</u>	<u>6,25,000</u>
Income from own operations		85,000
Income from subcontractors		<u>—</u>
Total income		<u><u>85,000</u></u>

Recommendation

Option 3 should be adopted from a financial viewpoint as it yields the highest profit of the three options. It is Rs. 19,000 (nearly 30%) better than the existing subcontracting arrangements.

C.A. Inter May 1990

Problem 48. (Equivalent Production—FIFO Method). The following data are available in respect of Process I for February 1990 :

(1) Opening stock of work in process : 800 units at a total cost of Rs 4,000.

(2) Degree of completion of opening work in process :

Materials	100%
Labour	60%
Overheads	60%

(3) Input of materials at a total cost of Rs. 36,800 for 9,200 units.

(4) Direct wages incurred Rs. 16,740.

(5) Production overhead Rs. 8,370.

(6) Units scrapped 1,200 units. The stage of completion of these units was :

Materials	100%
Labour	80%
Overheads	80%

(7) Closing work in process : 900 units. The stage of completion of these units was :

Materials	100%
Labour	70%
Overheads	70%

(8) 7,900 units were completed and transferred to the next process.

(9) Normal loss is 8% of the total input (opening stock *plus* units put in).

(10) Scrap value is Rs. 4 per unit.

You are required to:

- (a) compute equivalent production,
- (b) calculate the cost per equivalent unit for each element.
- (c) calculate the cost of abnormal loss (or gain), closing work in process and the units transferred to the next process using the FIFO method,
- (d) show the Process Account for February 1990.

Solution (a) Statement of Equivalent Production (FIFO Method)

Input		Output		Equivalent Production			
Particulars	Units	Particulars	Units	Materials Units	Labour & Overheads %	Units	%
O/stock of W.I.P.	800	Units completed-work on O/stock	800	—	—	320	40%
Units introduced	9,200	—New units	7,100	7,100	100%	7,100	100%
		Closing stock	900	900	100%	630	70%
		Normal Loss	800	—	—	—	—
		Abnormal Loss	400	400	100%	320	100%
	10,000		10,000	8,400		8,370	

(b) Statement of cost per equivalent units for each element

Particulars	Cost	Equivalent units	Cost per unit
Material Rs. 36,800			
Less : Scrap realisation (800 units @ Rs. 4) 3,200	Rs. 33,600	8,400	4.00
Labour 16,740		8,370	2.00
Overheads 8,370		8,370	1.00

(c) Statement showing cost of abnormal loss, scrap value and units transferred to the next process.

Particulars	Cost per unit	Equivalent unit	Total cost
Abnormal Loss			
Material	Rs. 4.00	400	Rs. 1,600
Labour	2.00	320	640
Overheads	1.00	320	320
			<u>2,560</u>
Closing WIP			
Material	4.00	900	3,600
Labour	2.00	630	1,260
Overheads	1.00	630	630
			<u>5,490</u>
7,900 Units transferred to next process			
(i) Cost of opening WIP (80 units)			<u>4,000</u>
(ii) Cost incurred on opening WIP			
Material	—	—	—
Labour	2.00	320	640
Overheads	1.00	320	320
			<u>960</u>
(iii) Cost of Completing 7,100 units			
Material	4.00	7,100	28,400
Labour	2.00	7,100	14,200
Overheads	1.00	7,100	7,100
			<u>49,700</u>
Total (i + ii + iii)			<u>54,660</u>

Process Account for February 1990

Particulars	Units	Amount	Particulars	Units	Amount
To Opening WIP	800	Rs. 4,000	By Finished Goods	7,900	54,660
" Materials	9,200	36,800	" Closing WIP	900	5,490
" Labour		16,740	" Normal Loss	800	3,200
" Overheads		8,370	" Abnormal Loss	400	2,560
	10,000	65,910		10,000	65,910

Problem 149. (Product-Mix). From the following particulars, find the most profitable product mix and prepare a statement of profitability of that product mix :—

	Product A	Product B	Product C
Units budgeted to be produced and sold	1,800	3,000	1,200
Selling price per unit Rs.	60	55	50
Requirement per unit :			
Direct Materials	5 kg	3 kg	4 kg
Direct Labour	4 hrs	3 hrs	2 hrs
Variable overheads	Rs. 7	Rs. 13	Rs. 8
Fixed Overheads	Rs. 10	Rs. 10	Rs. 10
Cost of Direct Materials per kg	Rs. 4	Rs. 4	Rs. 4
Direct Labour Hour Rate	Rs. 2	Rs. 2	Rs. 2
Maximum Possible Units of Sales	4,000	5,000	1,500

All the three products are produced from the same direct material using the same type of machines and labour. Direct labour, which is the key factor, is limited to 18,600 hours.

Solution Statement showing the most profitable product mix

Particulars	(Rs per unit)		
	Products		
	A	B	C
(i) Selling price	60	55	50
(ii) Variable costs			
Direct materials @ Rs. 4 kg.	20	12	16
Direct labour @ Rs. 2 per hrs.	8	6	4
Variable Overheads	7	13	8
Total Variable Costs	35	31	28
(iii) Contribution (i) — (ii)	25	24	22
(iv) Direct labour hours per unit	4 hrs.	3 hrs.	2 hrs.
(v) Contribution per direct labour hr.	6.25	8.00	11.00
Ranking	III	II	I

Statement showing the profitability of most profitable product mix

Key factor is 18,600 direct labour hours. Maximum possible units of each product should be produced according to ranking. 18,600 labour hours will be utilized according to the following ranking.

	<i>Labour hours</i>
Product C (1,500 units \times 2 hrs)	= 3,000
Product B (5,000 units \times 3 hrs)	15,000
Product C (600 hrs \div 4 hrs. = 150 units)	<u>600*</u>
	<u>18,600</u>

* Balance hours

<i>Particulars</i>	<i>Products</i>			<i>Total</i>
	<i>C</i>	<i>B</i>	<i>A</i>	
(i) Production (Units)	1,500	5,000	150	
(ii) Contribution per unit	Rs. 22	Rs. 24	Rs. 25	
(iii) Total contribution (i)+(ii)	Rs. 33,000	Rs. 1,20,000	Rs. 3,750	Rs. 1,56,750
Less Fixed overheads :				

Budgeted units @ Rs. 10

C	= 1,200 \times 10 = Rs. 12,000	
B	3,000 \times 10 =	30,000
A	1,800 \times 10 =	<u>18,000</u>
		<u>60,000</u>
Profit		<u>96,750</u>

Problem 150 (Joint Costs Allocation). A factory is engaged in the production of chemical Bomex and in the course of its manufacture, a by-product Brucil is produced, which after further processing has a commercial value. For the month of April 1990, the following are the summarised cost data :—

	<i>Joint Expenses</i>	<i>Separate Expenses</i>	
		<i>Bomex</i>	<i>Brucil</i>
Materials	Rs. 1,00,000	Rs. 6,000	Rs. 4,000
Labour	50,000	20,000	18,000
Overheads	30,000	10,000	6,000
Selling price per unit		98	34
Estimated profit per unit on sale of Brucil			4
No. of units produced		<i>Units</i> 2,000	<i>Units</i> 2,000

The factory uses reverse cost method of accounting for by-products whereby the sales value of by-products after deduction of the estimated profit, post separation costs and selling and distribution expenses relating to the by-products is credited to the joint process cost account.

You are required to prepare statements showing :

- the joint cost allocable to Bomex
- the product-wise and overall profitability of the factory for April 1990.

Solution. *Working note showing the Share of Joint Expenses allocable to the by-product Brucil*

		<i>By-Product Brucil</i>
Sales revenue (2,000 units × Rs. 34)		Rs. 68,000
Less : Profit (2,000 units × Rs. 4)		<u>8,000</u>
Cost of sales		60,000
Less : Selling and distribution expenses		nil
Less : Post-Separation Expenses (Rs. 4,000 + Rs. 18,000 + Rs. 6,000)		<u>28,000</u>
Cost of production at the point of separation		<u>32,000</u>
(i) Statement showing joint cost allocable to Bomex		
Total Joint costs of Bomex :		
Material	Rs. 1,00,000	
Labour	50,000	
Overheads	30,000	Rs. 1,80,000
Less : Joint costs of by-product Brucil at the point of separation (Working Note)		<u>32,000</u>
Cost of production of 2,000 units of Bomex		<u>1,48,000</u>
(ii) Statement showing product wise and overall profitability for the month of April 1990.		

	<u>Products</u>		Total
	<i>Bomex</i>	<i>Brucil</i>	
Sales Revenue :	Rs.	Rs.	Rs.
Bomex 2,000 × Rs. 98	1,96,000		
Brucil 2,000 × Rs. 34		68,000	
Less : Cost of production at the point of separation	1,48,000	32,000	
Post separation cost	<u>36,000</u>	<u>28,000</u>	<u>60,000</u>
Profit	<u>12,000</u>	<u>8,000</u>	<u>20,000</u>

Problem 151. (Reconciliation of Cost and Financial Accounts). The following figures have been extracted from the Financial Accounts of a Manufacturing Firm for the first year of its operation :

Direct Material Consumption	Rs. 50,00,000
Direct Wages	30,00,000
Factory Overheads	16,00,000
Administrative Overheads	7,00,000
Selling and Distribution Overheads	9,60,000
Bad Debts	80,000
Preliminary Expenses written off	40,000
Legal Charges	10,000
Dividends Received	1,00,000
Interest Received on Deposits	20,000
Sales (1,20,000 units)	1,20,00,000
Closing Stocks :	

Finished Goods (4,000 units)	3,20,000
Work in Progress	2,40,000

The cost accounts for the same period reveal that the direct material consumption was Rs. 56,00,000. Factory overhead is recovered at 20% on prime cost. Administration overhead is recovered at Rs. 6 per unit of production. Selling and distribution overheads are recovered at Rs. 8 per unit sold.

Prepare the Profit and Loss Accounts both as per financial records and as per cost records. Reconcile the profits as per the two records.

Solution

Profit and Loss Account (As per Financial Records)			
Dr.	Rs. '000		Cr. Rs '000
To Direct materials	5,000	By Sales (1,20,000 units)	12,000
" Direct wages	3,000	" Closing stock :	
" Factory overheads	1,600	WIP	240
" Gross profit	<u>2,960</u>	Finished good (4,000 units)	<u>320</u>
	<u>12,560</u>		<u>12,560</u>
To Admn. overheads	700	By Gross Profit	2,960
" S&D overheads	960	" Dividend	100
" Legal charges	10	" Interest	20
" Preliminary expenses w/o	40		
" Bad debts	80		
" Net profit	<u>1,290</u>		
	<u>3,080</u>		<u>3,080</u>

Statement showing cost and profit as per cost records

	Amount
Direct material	Rs. 56,00,000
Direct wages	<u>30,00,000</u>
Prime cost	86,00,000
Factory overheads (20% on Prime cost)	<u>17,20,000</u>
	1,03,20,000
Less closing WIP	<u>2,40,000</u>
Works cost of (1,20,000 + 4,000) = 1,24,000 units	1,00,80,000
Administration overheads (1,24,000 × Rs. 6)	<u>7,44,000</u>
Cost of production (1,24,000 units)	1,08,24,000
Less : Finished stock (4,000 × Rs. 87.29)*	<u>3,49,160</u>
Cost of goods sold (1,20,000 units)	1,04,74,840
Selling and distribution expenses (1,20,000 × Rs. 8)	<u>9,60,000</u>
Cost of Sales	1,14,34,840
Sales	<u>1,20,00,000</u>
Net Profit	<u>5,65,160</u>

**Statement showing the reconciliation of profits as
per financial accounts and as per cost accounts.**

Profit as per cost records	Rs. 5,65,160
Add : Excess expenses charged in cost accounts :	
Material	Rs. 6,00,000
Factory overheads	1,20,000
Admn. overheads	44,000
Add : Income <i>not</i> considered in cost accounts :	
Dividend	1,00,000
Indirect received	<u>20,000</u>
	8,84,000
	14,49,160
Less : Expenses <i>not</i> charged in cost accounts :	
Legal charges	10,000
Preliminary expenses w/o	40,000
Bad Debts	80,000
Less : Overvaluation of closing stock in cost records	<u>29,160</u>
	1,59,160
Profit as per financial records	<u><u>12,90,000</u></u>

*Rs. 1,08,24,000 + 1,24,000 = Rs. 87.29

Problem 152. (Remuneration and Incentives). (a) The standard hours of Job X is 100 hours. The job has been completed by Amar in 60 hours, Akbar in 70 hours and Anthony in 95 hours.

The bonus system applicable to the job is as follows :

Percentage of time saved to time allowed	Bonus
Saving upto 10%	10% of time saved
From 11% to 20%	15% of time saved
From 21% to 40%	20% of time saved
From 41% to 100%	25% of time saved

The rate of pay is Re. 1 per hour. Calculate the total earnings of each worker and also the rate of earnings per hour.

(b) **(Machine Hour Rate)** A machine was purchased on January 1, 1990, for Rs. 5 lakhs. The total cost of all machines inclusive of the new machine was Rs. 75 lakhs. The following further particulars are available :

Expected life of the machine 10 years.

Scrap value at the end of ten years Rs. 5,000.

Repairs and maintenance for the machine during the year Rs. 2,000.

Expected number of working hours of the machine per year, 4,000 hours.

Insurance premium annually for all the machines Rs. 4,500.

Electricity consumption for the machine per hour (@ 75 paise per unit) 25 units.

Area occupied by the machine 100 sq. ft.

Area occupied by other machines 1,500 sq. ft.

Rent per month of the department Rs. 800.

Lighting charges for 20 points for the whole department, out of which three points are for the machine Rs. 120 per month.

Compute the machine hour rate for the new machine on the basis of the data given above.

Solutions. (a) Statement Showing total earnings and rate of earnings of each of the three workers.

	<i>Amar</i>	<i>Akbar</i>	<i>Anthony</i>
Standard hours	100	100	100
Time taken (hours)	60	70	95
Time saved (hours)	40	30	5
Percentage of time saved to std. time	40%	30%	5%
Bonus percentage	20%	20%	10%
Bonus hours	$40 \times 20\% = 8$	$30 \times 20\% = 6$	$5 \times 10\% = 0.5$
Total earning @ Re. 1	Rs. 68	Rs. 76	Rs. 95.5
Payment for bonus hours	$8 \div 60 = 0.133$	$6 \div 70 = 0.086$	$0.5 \div 95 = 0.005$
Wage rate per normal hour	<u>1.000</u>	<u>1.000</u>	<u>1.000</u>
Rate of earning per hour	<u>Rs. 1.133</u>	<u>Rs. 1.086</u>	<u>Rs. 1.005</u>

Computation of Machine Hour Rate

	<i>Total</i>	<i>Per Hour</i>
Expected number of machine hours	<u>4,000 hours</u>	
Standing charges:		
Depreciation $\frac{\text{Rs. } 5,00,000 - 5,000}{10 \text{ yrs.}}$	Rs. 49,500	
Repairs and maintenance	2,000	
Insurance premium $4,500 \times \frac{\text{Rs. } 5 \text{ lakhs}}{\text{Rs. } 75 \text{ lakhs}} =$	300	
Rent $\text{Rs. } 800 \times 12 \text{ months} \times \frac{100 \text{ sq. ft}}{1,600 \text{ sq. ft}} =$	600	
Lighting charges $\text{Rs. } 120 \times 12 \times \frac{3 \text{ points}}{20 \text{ points}} =$	<u>216</u>	
Total standing charges	52,616	
Per hour $\text{Rs. } 52,616 \div 4,000$		Rs. 13.154
Machine Expenses		
Electricity consumption 25 units $\times \text{Re. } 0.75$		<u>18.750</u>
Machine Hour Rate		<u><u>31.904</u></u>

C.A. Final May 1990

Problem 153. (Integrated Accounting including Reconciliation when various variances are given). (a) Briefly explain the cost ledger

accounting system and the Integrated accounting system of maintenance of cost accounts. What advantages do you expect in an integrated system ?

(b) Uptodate Ltd., which keeps cost control accounts in addition to the normal financial books of accounts is in the habit of preparing half-yearly accounts for ascertaining its performance.

From the information supplied hereunder, you are required to write up the cost ledger and prepare a Costing Profit and Loss Account showing the appropriate variances for the first half of the current year. Also ascertain the profit for the same period as given by the financial accounts, reconciling this with the profit shown in the Cost Accounts.

In the Control Accounts, the balance at the end of the previous year were

	<i>At Standard Cost Rs. ('000)</i>
General Ledger Control A/c	3,450
Raw Materials	1,025
Work in Progress	1,840
Finished Goods	585

The summary of transactions during the first half of the current year are

	<i>Rs. ('000)</i>	
Purchase of Raw Materials on Credit	4,045	
Material Price Variance (Calculated at the time of purchase)	95	Adverse
Material Usage Variance	75	Adverse
Direct Wages actual (6,50,000 Hrs)	3,390	
Standard Wages @ Rs. 2.50 per hour	3,275	
Indirect Wages	1,155	
Indirect Materials and Expenses	965	
Depreciation	525	
Administration Selling and Distribution Expenses	2,925	
Materials issued to production at standard prices	4,000	
Factory Overheads absorbed to production at Rs. 2.00 per standard direct labour hour	2,620	
Sales on credit	15,735	
<i>Items of a purely financial nature :</i>		
Debenture interest paid	180	
Interest received on investments	35	
Donations and Charities	135	

	<i>Costing Books at Standard</i>	<i>Financial Books at Actuals</i>
<i>Opening Stock :</i>	<i>Rs.</i>	<i>Rs.</i>
Raw Materials	1,025	1,050
Work in progress	1,840	1,825
Finished Goods	585	625

Closing Stock :

Raw Materials	900	895
Work in progress	1,725	1,755
Finished Goods	595	600

Please take note that Administration, Selling and Distribution Expenses and all variances, will be charged to Costing Profit and Loss Account.

Solution (a) Please refer to "Advanced Cost and Management Accounting Text" by Saxena and Vashist.

(b)

Cost Ledger
General Ledger Control A/c (All values in Rs. '000)

To Sales A/c	15,735	By Balance b/d	3,450
" Balance c/d	3,220	" Raw Materials Control A/c	3,950
		" Material Price Variance A/c	95
		" Direct Wages Control A/c	3,390
		" Factory Overhead Control A/c :	
		Indirect Wages	1,155
		Depreciation	525
		Indirect Material and Expenses	<u>965</u> 2,645
		" Administration, Selling and Distribution Expenses A/c	2,925
		" Costing P&L A/c (Net Profit)	<u>2,500</u>
	<u>18,955</u>		<u>18,955</u>

Raw Materials Control A/c

To Balance b/d	1,025	By Work in Progress Control A/c	4,000
" General Ledger Control A/c (Credit purchase)	3,950	" Material usage variance A/c	75
	<u>4,975</u>	Balance c/d	<u>900</u>
			<u>4,975</u>

Work in Progress Control A/c

To Balance b/d	1,840	By Finished Goods	
" Raw materials Control A/c	4,000	Stock Control A/c	10,010
" Direct wages Control A/c	3,275	(Balancing figure)	
" Factory overhead Control A/c	<u>2,620</u>	" Balance c/d	<u>1,725</u>
	<u>11,735</u>		<u>11,735</u>

Finished Goods Stock Control A/c

Rs. '000

To Balance b/d	585	By Cost Goods Sold A/c	10,000
" Work in progress Control A/c	10,010	(Balancing figure)	
	<u>10,595</u>	" Balance c/d	<u>595</u>
			<u>10,595</u>

Direct Wages Control A/c

To General Ledger Control A/c (For Actual hrs. 6,50,000)	3,390	By Work-in-progress Control A/c	3,275
	<u>3,390</u>	" Direct Wages Variance A/c	<u>115</u>
			<u>3,390</u>

Factory Overhead Control A/c

To General Ledger Control A/c		By Work in progress Control A/c	
Indirect wages	1,155	(Overhead absorbed)	2,620
Indirect material & expenses	965	" Factory Overhead Variance A/c	25
Depreciation	2,525		
	<u>2,645</u>		<u>2,645</u>

Material Price Variance A/c

To General Ledger Control A/c	95	By Costing Profit and Loss A/c	95
(Credit purchase of materials)	-----		-----
	<u>95</u>		<u>95</u>

Material Usage Variance A/c

To Raw Material Control A/c	5	By Costing Profit and Loss A/c	5
	<u>5</u>		<u>5</u>

Direct Wages Variance A/c

To Direct Wage Control A/c	115	By Costing Profit and Loss A/c	115
	<u>115</u>		<u>115</u>

Factory Overhead Variance A/c

To Factory Overhead Control A/c	25	By Costing Profit and Loss A/c	25
	<u>25</u>		<u>25</u>

Administration, Selling and Distribution Expenses A/c

To General Ledger Control A/c	2,925	By Costing Profit and Loss A/c	2,925
	<u>2,925</u>		<u>2,925</u>

Cost of Goods Sold A/c

To Finished Goods Stock Control A/c	10,000	By Costing Profit and Loss A/c	10,000
	<u>10,000</u>		<u>10,000</u>

Sales A/c

To Costing Profit and Loss A/c	15,735	By General Ledger Control A/c	15,735
	<u>15,735</u>		<u>15,735</u>

Costing Profit and Loss A/c

To Cost of Goods sold A/c (Standard)	10,000	By Sales A/c	10,000
" Administration, Selling and Distribution Expenses A/c	2,925		
" Material Price Variance A/c	95		
" Material Usage Variance A/c	75		
" Direct Wages Variance A/c	115		
" Overhead Variance A/c	25		
" General Ledger Control A/c (Net profit)	<u>2,500</u>		
	<u>15,735</u>		<u>15,735</u>

Notes : (1) Actual Direct Wages are for 6,50,000 hours whereas standard wages work out for 13,10,000 hours. The difference in actual and standard wages has been shown as total direct wages variance without splitting it into rate and efficiency.

(2) The difference between actual factory overheads and factory overheads absorbed has been shown as factory overhead variance without identifying its components.

Financial Books

Trading and Profit and Loss A/c for the year ended....

To Opening Stock :		By Sales A/c	15,735
Raw material	1,050	Closing Stock :	
Work in progress	1,825	Raw materials	895
Finished stock	<u>625</u>	Work in progress	1,755
	3,500	Finished goods	<u>600</u>
Purchase (Raw material)	4,045		3,250
Direct Wages	3,390	Interest received	35
Indirect Wages	1,155		
Indirect material and expenses	965		
Depreciation	525		
Administration, Selling and			
Distribution Expenses	2,925		
Debenture interest	180		
Donations & Charities	135		
Profit	<u>2,200</u>		
	<u>19,020</u>		<u>19,020</u>

Reconciliation of Financial Accounts Profit with the profit as shown by the Cost Accounts

		Rs. ('000)
Profit as per Cost Accounts		2,500
Add Difference in valuation of :		
Opening stock of Work in Progress	15	
Closing stock of Work in Progress	30	
Closing stock of Finished Goods	5	
Interest received on investments not included in cost accounts	<u>35</u>	<u>85</u>
		2,585
Less : Difference in valuation of :		
Opening stock of Raw Material	25	
Opening stock of Finished Goods	40	
Closing stock of Raw Materials	5	
Items purely of financial nature not included in cost accounts :		
Debenture interest paid	180	
Donations and charities	<u>135</u>	<u>385</u>
Profit as per Financial Accounts		2,200

Problem 154. (Cost Centre and Responsibility Centre wise Report). (a) Explain clearly the terms "Cost Centre" and "Responsibility Centre" and their utility to management.

(b) Jimmedar Works Ltd. has at the factory three Production Departments. Machine Shop, Fabrication and Assembly which are the responsibility of the Shop Superintendent. The Shop Superintendent along with Materials Manager, Planning Superintendent and Maintenance Engineer report to the Works Manager who along with the Works Manager report to the Managing Director of the Company. The following data relating to a month's performance are called out from the books of the company.

	Budget	Variance from Budget
	Rs.	Rs.
Sales Commission	800	50A
Raw Material & Components		
—Machine Shop	900	20A
Publicity Expenses	1,100	100A
Printing & Stationery	3,200	200F
Travelling Expenses	4,000	200A
Wages-Machine Shop	800	10F
—Fabrication	600	20A
—Assembly	720	10A
Material-Assembly	760	40A
—Fabrication	460	10A
Utilities-Machine Shop	320	10A
—Assembly	470	60F
—Fabrication	560	30F
—Maintenance	400	20A
—Stores	210	40F
—Planning	180	20A
Shop Superintendent's Office		
—Salaries & Expenses	1,100	22F
Depreciation-Factory	3,880	40A
Works Manager's Office		
Salaries & administration	3,810	40A
General Office salaries & administration	4,270	30A
Managing Director's		
Salary & administration	2,800	20F

[A = Adverse, F = Favourable]

- (i) Treating the Machine Shop, Fabrication and Assembly as Cost Centres, prepare Cost Sheets for each centre with the help of this additional information :

The Shop Superintendent devotes his time amongst Machine Shop, Fabrication and Assembly in the ratio 4 : 3 : 4. Other Factory Overheads are absorbed on the basis of Direct Labour in each Cost Centre.

Office, Administration, Selling and Distribution Overheads are borne equally by the Cost Centres.

- (ii) Treating the Machine Shop, Fabrication and Assembly as Responsibility Centres prepare a Responsibility Accounting report for the Shop Superintendent.

Solution : (a) Please refer to "Advanced Cost and Management Accounting—Text" by Saxena and Vashist.

**(b) (i) Cost Sheets for Machine Shop, Fabrication and
Assembly treating them as Cost Centres**

	<i>Machine Shop</i>		<i>Fabrication</i>		<i>Assembly</i>	
	<i>Budget</i>	<i>Actual</i>	<i>Budget</i>	<i>Actual</i>	<i>Budget</i>	<i>Actual</i>
Raw Material and components	Rs. 900	Rs. 920	Rs. 460	Rs. 470	Rs. 760	Rs. 800
Wages	800	790	600	620	720	730
Utilities	<u>320</u>	<u>330</u>	<u>560</u>	<u>530</u>	<u>470</u>	<u>410</u>
Prime Cost	2,020	2,040	1,620	1,620	1,950	1,940
Shop Supdt's office salaries and expenses (Ratio 4 : 3 : 4)	400	392	300	294	400	392
* Other factory overheads	<u>3,200</u>	<u>3,160</u>	<u>2,400</u>	<u>2,480</u>	<u>2,880</u>	<u>2,920</u>
Factory cost	5,620	5,592	4,320	4,394	5,230	5,252
@ Adm., Selling & Distribution overheads (one-third each)	5,390	5,443	5,390	5,443	5,390	5,444
Total Cost	<u>11,010</u>	<u>11,035</u>	<u>9,710</u>	<u>9,837</u>	<u>10,620</u>	<u>10,696</u>

* *Factory overheads* *Budget* *Actual*
Utilities :

Maintenance	Rs. 400	Rs. 420
Stores	210	170
Planning	180	200
Depreciation	3,880	3,920
Works Manager's office expenses	<u>3,810</u>	<u>3,850</u>
Total factory overheads	<u>8,480</u>	<u>8,560</u>
Direct wages (Rs. 800 + 600 + 720)	<u>2,120</u>	<u>2,140</u>
Factory overhead as a % of direct wages	400%	400%

@ *Administration, Selling and Distribution Overheads*

	<i>Budget</i>	<i>Actual</i>
Sales commission	Rs. 800	Rs. 850
Publicity expenses	1,100	1,200
Printing and stationery	3,200	3,000
Travelling expenses	4,000	4,200
General office salaries and administration	4,270	4,300
M.D. Salary & administration	<u>2,800</u>	<u>2,780</u>
	<u>16,170</u>	<u>16,330</u>

These overheads are to be divided equally among the production departments.

b(ii) Responsibility Accounting Report for the Shop Superintendent treating the machine machine shop, fabrication as responsibility centres

	<i>Budget</i>	<i>Actual</i>	<i>Variance</i>
1. <i>Machine shop</i>			
Material	Rs. 900	920	20(A)
Labour	800	790	10(F)
Utilities	<u>320</u>	<u>330</u>	<u>10(A)</u>
	<u>2,020</u>	<u>2,040</u>	<u>20(A)</u>

2. Fabrication			
Material	460	470	10(A)
Labour	600	620	20(A)
Utilities	<u>560</u>	<u>530</u>	<u>30(F)</u>
	<u>1,620</u>	<u>1,620</u>	
3. Assembly			
Material	760	800	40(A)
Labour	720	730	10(A)
Utilities	<u>470</u>	<u>410</u>	<u>60(F)</u>
	<u>1,950</u>	<u>1,940</u>	<u>10(F)</u>
Total (1 + 2 + 3)	<u>5,590</u>	<u>5,600</u>	<u>10(A)</u>

Note : Since shop superintendent's office salaries and expenses include his salary also, it has been assumed that these are not controlled by him and hence *not* included.

Problem 155. (Probabilistic B.E. Analysis). (a) The usual assumptions underlying the Break Even analysis are its limitations. List out those assumptions.

(b) Nuksan Ltd. which makes only one product, sells 10,000 units of its product making a loss of Rs. 10,000. The variable cost per unit of the product is Rs. 8 and the fixed cost is Rs. 30,000.

The company has estimated its sale demand as under :

Sales units	Probability
10,000	0.10
12,000	0.15
14,000	0.20
16,000	0.30
18,000	0.25

What is the probability the company will continue to make losses ?

What is the probability that the company will make a profit of least Rs. 6,000 ?

Solution (a) Please refer to "Advanced cost and Management Accounting Text" by Saxena and Vashist.

Sales (units)	10,000
(b) Fixed Cost	Rs. 30,000
Loss	<u>(10,000)</u>
Contribution	20,000
Contribution per unit	2
Break-even point	Rs. 30,000 ÷ 2 = 15,000
Any sales below break-even point will result in loss.	

Probability that the company will continue to make losses.

Sales (units)	Probability
10,000	0.10

12,000	0.15
14,000	<u>0.20</u>
Probability to continue making losses	<u>0.45</u>
<i>Probability that the company will make a profit of atleast Rs. 6,000</i>	
Fixed cost	Rs. 30,000
Profit	<u>6,000</u>
Contribution	36,000
Contribution per unit	Rs. 2

Units of product to be sold = Rs. 36,000 ÷ 2 = 18,000 units

At 18,000 sales units the probability to make a profit of Rs. 6,000 is 0.25.

Problem 156. (Relevant cost Analysis and different pricing options). (a) Explain with illustrative examples the following cost concepts :

(i) Relevant Cost; (ii) Sunk Cost; and (iii) Opportunity Cost.

(b) Magic Carpets Associates have just developed a new carpet design with the brand name "Arabian Nights". Sales demand is very difficult to predict but is very much depends upon the selling price. At a price of Rs. 30 per square meter it is estimated that the annual sales demand would be between 50,000 and 90,000 sq. metres per annum. At a price of Rs. 40 per sq. metre, sales demand would be between 34,000 and 44,000 sq. metres per annum. As regards cost, at production volumes of 45,000 sq. metres or less per annum, attributable fixed costs would be Rs. 2,12,000 per annum and variable costs would be Rs. 32, per sq. metre. At higher production volumes, attributable fixed costs would increase to Rs. 3,08,000 but variable costs per sq. metre would be only Rs. 24.

'Arabian Nights' has been developed at a cost of Rs. 80,000.

When the product is marketed, an amount of Rs. 70,000 per annum will be charged to the operation towards Head Office Expenses.

The production of the new carpet will have to be supervised by a foreman. In order to find time for supervision he has to give up work in another department, for which he is paid a salary of Rs. 1,000 per month.

The production of 'Arabian Nights' would be undertaken, of course, in a division of the factory which is at present rented out to M/s Shine or Rain Ltd., Umbrella makers for an amount of Rs. 10,000 per quarter.

You are required to calculate the margin of safety, as a percentage of expected sales volume at both the maximum and minimum sales volume for the two price levels and decide on the selling price per sq. metre.

Solution : (a) Please refer to "Advanced Cost and Management Accounting—Text" by Saxena and Vashist.

(b) **Relevant Fixed Costs**

	At a price of Rs. 30 per sq. mt.	At a price of Rs. 40 per sq. mt.
Attributable fixed costs	Rs. 3,08,000	Rs. 2,12,000
Foreman's salaries (Rs. 1,000 × 12)	12,000	12,000

Rent foregone (Rs. 10,000 × 4)	<u>40,000</u>	<u>40,000</u>
Total relevant fixed cost	<u>3,60,000</u>	<u>2,64,000</u>

Note : Development cost of Rs. 80,000 and Head Office Expenses (apportioned) of Rs. 70,000 is a sunk cost and as such *not* relevant to the decision.

Statement showing the margin of safety, as a percentage of expected sales volume at maximum and minimum sales volumes.

	<i>At a price of Rs. 30 per sq. mt.</i>	<i>At a price of Rs. 40 per sq. mt.</i>
Annual sales demand between (sq. mts.)	50,000 and 90,000	34,000 and 44,000
Variable cost	Rs. 24	Rs. 32
Contribution per sq. mt.	6	8
<u>Profit/(Loss) at minimum sales</u>		
Minimum sales volume (sq. mts.)	50,000	34,000
Total contribution	Rs. 3,00,000	2,72,000
Less : Relevant fixed costs	<u>3,60,000</u>	<u>2,64,000</u>
Profit/(Loss)	<u>(60,000)</u>	<u>8,000</u>
<u>Profit/(Loss) at maximum sales</u>		
Maximum sales volume (sq. mts.)	90,000	44,000
Total contribution	Rs. 5,40,000	3,52,000
Less : Relevant fixed costs	<u>3,60,000</u>	<u>2,64,000</u>
Profit	<u>1,80,000</u>	<u>88,000</u>

In order to find out the margin of safety, first determine the B.E. sales volume.

B.E. Sales (Fixed cost + contribution per sq. mt.)

	Rs. 3,60,000 ÷ 6 = 60,000 sq. mt.	Rs. 2,64,000 ÷ 8 = 33,000 sq. mt.
Margin of safety at minimum sales	Nil (Loss)	34,000 - 33,000 = 1,000
As a % of sales		(1,000 ÷ 34,000) × 100 = 2.94%
Margin of safety at maximum sales	90,000 - 60,000 = 30,000 sq. mt.	44,000 - 33,000 = 11,000 sq. mt.
As a % of sales	(30,000 ÷ 90,000) × 100 33⅓%	(11,000 ÷ 44,000) × 100 25%

Recommended Selling Price : At a price of Rs. 40 per sq. mt. the profit is earned at both minimum and maximum levels of sales. But this option does not yield optimum profit. However at the price of Rs. 30 per sq. mt. higher profit will be earned at the maximum and intermediate volume (beyond 74,667 sq. mts.). Intermediate level is arrived at as under :

Desired profit at maximum sales with a price of

Rs. 40 per sq. mt.	Rs. 88,000
Add relevant fixed costs at a price of Rs. 30 per sq. mt.	<u>3,60,000</u>
Total desired contribution at an intermediate level	<u>4,48,000</u>
Contribution per sq. mt. with a price of Rs. 30	6
Desired minimum sales volume	Rs. 4,48,000 ÷ 6 = 74,667 sq. mts.

It is therefore recommended that a price of Rs. 30 per sq. mt should be adopted, assuming that at this price sales would be above 74,667 sq. mts. when the profit at Rs. 30 will be equal to the profit from maximum sales volume at Rs. 40 per sq. mt.

Problem 157. (Absorption costing vs. Marginal Costing—Computation of bonus). (a) "The use of the absorption costing method in management decision-making process leads to anomalies"—Discuss.

(b) Topeless Products Ltd has several product lines with a sales manager in charge of each product line and he is paid a bonus based on the net income generated by his product line.

In analysing performance of one product line, the General Sales Manager noted that the sales declined from Rs. 8 lakhs last year to Rs. 6 lakhs for the current year. However the product line manager received a larger bonus than last year because net income increased from Rs. 90,000 last year to Rs. 1,20,000 for the current year.

The General Sales Manager wonders how the product line manager is entitled to a bonus with a decline in sales. He also wants to know how net income increased, when sales declined.

As a Cost Accountant you are required to prepare the income statements, based on which the bonus was paid. Explain with supporting figures why net income increased when sales declined. What do you think of the present method of paying the Bonus? Can you suggest some other method?

The data given in support for bonus payment are :

	Years 2	Year 1
Units sold @ Rs. 20	30,000	40,000
Standard variable cost of production per unit (Rs.)	8	8
Fixed Factory Overhead Cost (R.)	2,00,000	2,00,000
Selling & Distribution Expenses (assumed to be fixed) (Rs.)	1,40,000	1,40,000
Standard Fixed Factory Overhead per unit (Rs.)	5	5
Units produced	50,000	30,000
Opening finished goods inventory—Units		10,000

All factory overhead variances are written off to cost of goods sold.

Solution (a) Please refer to "Advanced Cost and Management Accounting—Text" by Saxena and Vashist.

(b) Statement showing income statement based on which the bonus was paid.

	Years 1	Year 2
Units sold @ Rs. 20 p.u.	40,000	30,000
Sales Value	Rs. 8,00,000	Rs. 6,00,000
<u>Cost of Sales :</u>		
Variable cost :		
Year 1 30,000 × Rs. 8	2,40,000	—
Year 2 50,000 × Rs. 8	—	4,00,000

Fixed factory overhead	<u>2,00,000</u>	<u>2,00,000</u>
Cost of production	4,40,000	6,00,000
Add opening stock :		
Year 1 $10,000 \times \text{Rs. } 13$	<u>1,30,000</u>	<u>---</u>
Year 2 Nil	5,70,000	6,00,000
Less closing stock		
Year 1 Nil	---	---
Year 2 * $20,000 \times \text{Rs. } 13$	<u>---</u>	<u>2,60,000</u>
Cost of goods sold	5,70,000	3,40,000
Add : Selling and distribution expenses	<u>1,40,000</u>	<u>1,40,000</u>
Cost of sales	<u>7,10,000</u>	<u>4,80,000</u>
Income (Sales minus cost of sales)	90,000	1,20,000

The above statement shows that income in year 2 has increased inspite of decrease in sale because fixed overheads have been carried over to next year as part of the value of closing stock in year 2.

The above method of paying bonus product-line (sales) manager cannot be considered appropriate. This method may be appropriate for payment of bonus to production manager. The relevant method for paying bonus to sales manager is the contribution method as shown below :

	Year 1	Year 2
Sales	Rs. 8,00,000	Rs. 6,00,000
Less : Variable cost	<u>3,20,000</u>	<u>2,40,000</u>
Contribution	4,80,000	3,60,000
Less : Fixed costs	<u>3,40,000</u>	<u>3,40,000</u>
Income	<u>1,40,000</u>	<u>20,000</u>

If bonus to sales manager is paid on the contribution method, sales manager cannot get more bonus when sales decline.

Problem 158. (Determination of initial selling price—NPV Approach). Electromatic Excellers Ltd. specialise in the manufacture of novel transistors. They have recently developed technology to design a new radio transistor capable of being used as an emergency lamp also. They are quite confident of selling all the 8,000 units that they would be making in a year. The capital equipment that would be required will cost Rs. 25 lakhs. It will have an economic life of 4 years and no significant terminal salvage value.

During each of the first four years promotional expenses are planned as under :

Year	1	2	3	4
Advertisement (Rs.)	1,00,000	75,000	60,000	30,000
Other expenses (Rs.)	50,000	75,000	90,000	1,20,000

Variable costs of producing and selling the unit would be Rs. 250 per unit.

Additional fixed operating costs incurred because of this new product are budgeted at Rs. 75,000 per year.

* Difference between units produced and units sold.

The company's profit goals call for a discounted rate of return of 15% after taxes on investments on new products. The income tax rate on an average works out to 40%. You can assume that the straight line method of depreciation will be used for tax and reporting.

Work out an initial selling price per unit of the product that may be fixed for obtaining the desired rate of return on investment.

Present value of annuity of Re. 1 received or paid in a steady stream throughout 4 years in the future at 15% is 3.0079.

Solution. Determination of initial selling price unit.

Let x be the initial selling price per unit.

Sales value = $8,000x$

Annual cash costs

Variable costs (Rs. 250) \times 8,000) Rs. 20,00,000

Advertisement and other expenses 1,50,000

Additional fixed operating costs 75,000

Total cash costs 22,25,000

Depreciation per annum = Rs. 25,00,000 \div 4 = Rs. 6,25,000

Profit for taxation purpose = $8,000x - (\text{Rs. } 22,25,000 + 6,25,000)$

= $8,000x - \text{Rs. } 28,50,000$

Tax @ 40% on profit = 40% of $(8,000x - \text{Rs. } 28,50,000)$

= $3,200x - \text{Rs. } 11,40,000$

Total annual cash outflow = Rs. 22,25,000 + $(3,200x - 11,40,000)$

= $3,200x + \text{Rs. } 10,85,000$

Net annual cashflow = $8,000x - (3,200x + 10,85,000)$

= $4,800x - 10,85,000$

Now the net value of initial cashflow = P.V. of cash inflow

Rs. 25,00,000 = $(4,800x - 10,85,000) \times 3.0079$

or $x = \text{Rs. } 399.20$

Hence selling price per unit will Rs. 399.20.

Alternative solution

Total cash costs per year (as above) Rs. 22,25,000

Less : Income tax (40%) 8,90,000

13,35,000

Less : Tax saving on depreciation $(25,00,000 \div 4) \times 40\%$ 2,50,000

Net annual cash outflow 10,85,000

P.V. factor for 4 years @ 15% = 3.0079

P.V. of annual cash outflow $(10,85,000 \times 3.0079)$ = 32,63,572

Initial investment 25,00,000

57,63,572

Divided by P.V. factor to get required annual revenue after

tax $(57,63,572 \div 3.0079)$ = 19,16,145

Required annual revenue before tax = $19,16,145 + 60\%$

= 31,93,575

Unit Selling price = $31,93,575 \div 8,000$ = Rs. 399.20

CS Inter June 1990

Problem 159. (Reconciliation of Cost and Financial Accounts). The following is a summary of the trading and profit and loss account of a manufacturing company for the year ended 31st March, 1988 :

Dr.	(Rs. '000)	Cr.	(Rs. '000)
To Material consumed	2,740	By Sales (1,20,000 units)	6,000
" Wages	1,510	" Finished stock	
" Factory expenses	830	(4,000 units)	160
" Administration expenses	382	" Work-in-progress :	
" Selling and distribution expenses	450	Materials	64
" Preliminary expenses (written off)	40	Wages	36
" Goodwill (written off)	20	Factory expenses	20
" Net profit	326	" Dividend received	18
	<u>6,298</u>		<u>6,298</u>

In the cost accounts the following allocations have been made :

- Factory expenses at 20% on prime cost.
- Administration expenses at Rs. 3 per unit of production.
- Selling and distribution expenses at Rs. 4 per unit of sales.

You are required to prepare a costing profit and loss account of the company and to reconcile the profit disclosed with that shown in the financial account.

Solution : Statement showing the profit as per costing profit and loss Account.

	Rs. '000
Material consumed	2,740
Wages	<u>1,510</u>
Prime cost	4,250
Factory expenses (20% of prime cost)	<u>850</u>
Total works cost	5,100
Less : Closing W.I.P.	
Material	64
Labour	36
Factory expenses	<u>20</u>
Works cost of completed units	4,980
Administrative expenses (1,24,000 × Rs. 3)	<u>372</u>
Cost of production	5,352
Less : Closing finished stock	
4,000 units × $\frac{5,352}{1,24,000}$	<u>173</u>
Cost of goods sold	5,179
Selling and distribution expenses (1,20,000 × 4)	<u>480</u>
Cost of sales	5,659
Sales (1,20,000 × Rs. 50)	<u>6,000</u>
Net Profit as per costing P&L A/c	<u>341</u>

Reconciliation Statement

		Rs. '000
Profit as per Cost Accounts		341
	Rs. '000	
Add: 1. Factory expenses overcharged	20	
2. Selling and distribution expenses	30	
3. Divident received not considered	<u>18</u>	<u>68</u>
		409
Less 1. Administration overhead undercharged	10	
2. Over-valuation of F. Stock in cost accounts	13	
3. Preliminary expenses written off	40	
4. Goodwill written off	<u>20</u>	<u>83</u>
Profit as per financial accounts		<u>326</u>

Problem 160. (Profit on incomplete contracts). Jain and Company obtained a contract for the building of an office for Rs. 3,00,000. Building operations started on 1st April, 1987 and at the end of the financial year, i.e. 31st March, 1988, they received from the party a sum of Rs. 1,20,000 being 80% of the amount of the surveyor's certificate. The following additional information are available from the books of Jain and Company :

	Rs.
Stores issued to contract	60,000
Stores on hand as on 31-3-1988	5,000
Wages paid	82,000
Plant purchased for the contract	10,000
Direct expenses	4,300
Plant to be depreciated at 10 per cent.	

You are required to prepare an account showing profit on contract upto 31-3-1988. Also discuss whether Jain and Company would be justified in taking the full amount of this profit to the credit of their profit and loss account.

Solution		Contract A/c	
To Stock issued	Rs. 60,000	By Stock in hand	Rs. 5,000
" Wages	82,000	" Plant at site	
" Plant	10,000	(after depreciation)	9,000
" Direct Exp.	4,300	" Work-in-progress :	
" Balance c/d	<u>7,700</u>	Work certified	<u>1,50,000</u>
	<u>1,64,000</u>		<u>1,64,000</u>
To Profit & Loss A/c	4,107	By Balance b/d	7,700
" Work-in-progress A/c	3,593		
(Reserve)			
	<u>7,700</u>		<u>7,700</u>

Jain and Company will *not* be justified in taking the full amount of this profit to profit and loss account. S.S.A.P.9. cannot be used in this situation because it determines the profit to date from estimated contract profit (estimated total profit) based on the ratio of cost of work completed to total estimated

contract cost. Since the work certified is half of the contract price, following formula should be used :

$$\frac{2}{3} \times \text{Notional profit} \times \frac{\text{Cash received}}{\text{Work certified}}$$

$$\text{or } \frac{2}{3} \times 7,700 \times \frac{80}{100} = \text{Rs. } 4,107$$

Problem 161. (Quotation for Export). A company manufacturing electric motors at a price of Rs. 6,900 each, made up as under :

	Rs.
Direct material	3,200
Direct labour	400
Variable overheads	1,000
Fixed overheads	200
Depreciation	200
Variable selling overheads	100
Royalty	200
Profit	<u>1,000</u>
	6,300
Central excise duty	<u>600</u>
	<u>6,900</u>

(i) A foreign buyer has offered to buy 200 such motors at Rs. 5,000 each. As a Cost Accountant of the company would you advise acceptance of the offer?

(ii) What should the company quote for a motor to be purchased by a company under the same management if it should be at cost?

Solution :

(a) It is supposed that capacity to manufacture exists.

(b) Since company is already manufacturing, following cost will continue to be incurred whether this offer is accepted or not

(i) Fixed overhead Rs. 200

(ii) Depreciation 200

(Presumed to be on time basis)

(iii) It is presumed that selling overheads are not relevant to export offer.

∴ **Relevant cost per unit for export will be .**

Direct material	Rs. 3,200
Direct Labour	400
Variable O.H.	1,000
Royalty (considering it is paid on production basis)	<u>200</u>
	<u>4,800</u>

∴ Offer from foreign buyer should be accepted to yield incremental profit of Rs. 40,000, i.e., (Rs. 5,000 - 4,800) × 200.

This will further increase by export incentive minus the cost of extra packing required for export. It should be noted that no excise duty is leviable on exports.

(ii) Following price should be quoted for a motor to be purchased by a company under the same management.

Price (excluding excise duty)	Rs. 6,300
Less : Profit	Rs. 1,000
Variable selling overheads	<u>100</u>
Price to be quoted	<u>5,200</u>

Note : Excise duty should be added wherever payable.

Problem 162. (Labour Hourly Rate). Calculate the labour hour rate of a worker P from the following data :

Basic pay	Rs. 200 p.m.
D.A.	Rs. 150 p.m.
Fringe	Rs. 100 p.m.

No. of working days in a year 300. 30 days full pay and 20 days half-pay leave in a year is availed and allowed. Assume 8 hourly day.

(b) What would be the effect on hourly rate if only 30 days full pay leave is allowed ?

(c) How can frauds in wage payment be prevented ?

Solution (a) Effective working hours

Working days in a year	= 300
Less : Leave days (30 + 20)	<u>50</u>
to Effective working days	<u>250</u>
Working hours in a day	8 hours

(a) Total effective working hours $250 \times 8 = 2,000$ hours

Total wages paid in a year :

	Monthly	Annual
Basic	Rs. 200	
D.A.	150	
Fringe benefits	<u>100</u>	
	$450 \times 12 =$	Rs. 5,400

Less : 20 days half pay or 10 days fully pay

$$\left(\frac{5,400}{3000} \times 100 \right) \quad \underline{180}$$

(ii) Net amount paid

Hourly rate (ii) + (i)

$$\text{Rs. } \frac{5,220}{270}$$

(b) Effective working days

Effective working hours

$$2,160 \text{ hours}$$

Total wages payable

$$\text{Rs. } 5,400$$

Hourly rate

$$\text{Rs. } 2.50$$

Effect on hourly rate = Rs. 2.61 - 2.50 = Re. 0.11

- (c) Please refer to "Advanced Cost and Management Accounting—Text" by Saxena and Vashist.

Problem 163. (Make or Buy Decision—Idle Capacity).

(a) What are the specific cost and non-cost factors to be considered in the make or buy decisions ?

(b) Expansion Ltd. manufacturers automobile accessories and parts. The following are the total costs of processing 1,00,000 units :

Direct material cost	Rs. 5 lakhs
Direct labour cost	Rs. 8 lakhs
Variable factory overhead	Rs. 6 lakhs
Fixed factory overhead	Rs. 5 lakhs.

The purchase price of the component is Rs. 22. The fixed overhead would continue to be incurred even when the component is bought from outside, although there would have been reduction to the extent of Rs. 2,00,000.

Required—(a) Should the part be made or bought considering that the present facility when released following a buying decision would remain idle ?

(b) In case the released capacity can be rented out to another manufacturer for Rs. 1,50,000 having good demand, what should be the decision ?

Solution : (a) Please refer to "Advanced Cost and Management Accounting—Text" by Saxena and Vashist.

(b) (i) Statement showing the cost to make or by

	Make (Rs./lakhs)	Buy (capacity to remain idle) (Rs./Lakhs.)
Relevant cost to make :		
Direct material	5	
Direct labour	8	
Variable factory overheads	6	
Purchase price	—	22
		(2)
Total relevant cost	19	20

Since the cost to make is less than that to buy, it is advisable to manufacture the component presuming idle capacity is not alternatively used.

(ii) Statement showing costs of two alternatives when released capacity is rented out

	Make (Rs. /Lakhs)	Buy (Rs. /Lakhs)
Relevant cost to make	19	—
Purchase price	—	22
Reduction in fixed overheads	—	(2)
Rented income from alternative use	—	(1.5)
Total relevant cost	19	18.50

In this situation, the decision is in favour of buying from outside source.

I.C.W.A. Inter June 1990

Problem 164. (Segregation of Semi-variable overheads).

Delta Engineering Limited produces a uniform type of product and has a manufacturing capacity of 3,000 units per week of 48 hours. From the cost records of the Company, the following data are available relating to output and cost for three consecutive weeks :

Week No.	Units Manufactured	Direct Material	Direct Labour	Factory Overheads (Variable & Fixed)
1	1,200	Rs. 9,000	Rs 3,600	Rs. 31,000
2	1,600	12,000	4,800	33,000
3	1,800	13,500	5,400	34,000

Assuming that the Company charges a profit of 20% on selling price, find out the selling price per unit when the weekly output is 2,000 units.

Solution : (a) Statement showing the selling price per unit when the weekly output is 2,000 units

	Total	Per unit
Direct material @ Rs. 7.50@	Rs. 15,000	Rs. 7.50
Direct wages @ Rs. 3@	6,000	3.00
Variable factory overhead @ Rs. 5*	10,000	5.00
Fixed factory overhead	<u>*25,000</u>	<u>12.50</u>
Total cost of production	56,000	28.00
Profit 20% on sale or 25% on cost	<u>14,000</u>	<u>7.00</u>
Selling Price	<u>70,000</u>	<u>35.00</u>

@ Material cost per unit = Rs. 9,000 ÷ 1,200 = Rs. 7.50

Direct wages per unit = Rs 3,600 ÷ 1,200 = 3.00

*Calculation of fixed overhead

Units	Factory overheads
1,800	Rs. 34,000
<u>1,200</u>	<u>31,000</u>
<u>600</u>	<u>3,000</u>

Variable F.O. = Rs. 3,000 ÷ 600 = Rs. 5

Fixed F.O. = Rs. 31,000 – (1,200 × 5)

= Rs. 25,000

Problem 165. (Moving Weighted Average Method Pricing Issues). The Stock-Ledger Account for material X in a manufacturing concern reveals the following data for the quarter ended September 30, 1989.

Receipts				Issues	
	Quantity	Price		Quantity	Amount
	Units	Rs.		Units	Rs.
July 1					
Balance b/d	1,600	2.00		—	
July 9	3,000	2.20		—	
July 13	—	—		1,200	2,556

August 5	—	—	900	1,917
August 17	3,600	2.40	—	—
August 24	—	—	1,800	4,122
September 11	2,500	2.50	—	—
September 27	—	—	2,100	4,971
September 29	—	—	700	1,656

Physical verification on September 30, 1989 revealed an actual stock of 3,800 units. You are required to :

(a) Indicate the method of pricing employed in the above.

(b) Complete the above account by making entries you would consider necessary including adjustments, if any, and giving explanations for such adjustments.

Solution. (a) Moving Weighted Average Method of pricing issues has been adopted. For example, the issue of 1,200 units on July 13 has been made at the rate of Rs. 2.13 per unit which is the moving weighted rate.

Stock Ledger Account for Material

1989 Date	Receipts			Issues			Stock		
	Units	Rate Rs.	Value Rs.	Units	Rate	Value	Units	Rate Rs.	Value Rs.
July 1	—	—	—	—	—	—	1,600	2.00	3,200
July 9	3,000	2.20	6,600	—	—	—	4,600	2.13	9,800
July 13	—	—	—	1,200	3.13	2,556	3,400	2.13	7,244
Aug 5	—	—	—	900	2.13	1,917	2,500	2.13	5,327
17	3,600	2.40	8,640	—	—	—	6,100	2.29	13,967
24	—	—	—	1,800	2.29	4,122	4,300	2.29	9,845
Sept. 11	2,500	2.50	6,250	—	—	—	6,800	2.37	16,095
27	—	—	—	2,100	2.37	4,971	4,700	2.37	11,124
29	—	—	—	700	2.37	1,656	4,000	2.37	9,468
30	—	—	—	*200	2.37	474	3,800	2.37	9,006

*This is not an issue against a store issue voucher. This is an adjustment to reconcile the ledger balance with balance as per physical verification. Presuming it to be a normal loss the following entry may be passed by the Accounts Department :

Production Overhead A/c Dr.	Rs. 474
To Stores Control A/c	Rs. 474

(Being normal loss of 200 units)

Problem 166. (a) (Methods of disposal of underabsorbed overheads). XYZ Company uses a historical cost system and applies overheads on the basis of 'predetermined rates'. The following data are available from the records of the Company for the year ended March 31, 1990.

Manufacturing Overheads	Rs. 8,50,000
Manufacturing Overheads applied	7,50,000
Work-in-progress	2,40,000
Finished Goods Stock	4,80,000
Cost of Goods Sold	16,80,000

Apply two methods for disposal of underabsorbed overheads showing the implications of each method on the profits of the Company.

(b) (Ratios). In a manufacturing shop Product X requires 2.5 man-hours and Product Y requires 6 man-hours. In a month of 25 working days of 8 hours a day, 2,000 units of X and 1,000 units of Y were produced. The Company employs 50 workers in the shop and the budgeted man-hours are 1,08,000 for the year. You are required to work out the capacity ratio, activity ratio and efficiency ratio.

Solution : (a) Actual manufacturing overheads.	Rs. 8,50,000
Manufacturing overheads recovered	7,50,000
Under-absorbed Overhead	1,00,000

Method I

The entire overhead may be treated as part of cost of goods sold. In that case, profit will be reduced by Rs. 1,00,000. Adjustment entry will be :

Cost of Sales A/c Dr.	Rs. 1,00,000
To Manufacturing overhead A/c	Rs. 1,00,000

(Being the entry for underabsorbed overheads)

Cost of goods sold	Rs. 16,80,000 + 1,00,000
	= Rs. 17,80,000.

Method II.

Rs. 1,00,000 may be charged proportionately to cost of goods sold, work in progress and finished goods stock.

	Actual	Under absorbed	Total
	Rs.	Rs.	Rs.
Cost of goods sold	16,80,000	70,000	17,50,000
Work in Progress	2,40,000	10,000	2,50,000
Finished Goods stock	4,80,000	20,000	5,00,000
	<u>25,00,000</u>	<u>1,00,000</u>	<u>25,00,000</u>

Profit will be reduced by Rs. 70,000, W.I.P. will increase by Rs. 10,000, finished goods stock will increase by Rs. 20,000. Stock will increase by Rs. 30,000 thereby increasing the assets by Rs. 30,000. This will affect profit in subsequent period.

Adjustment entry will be :

Cost of Goods Sold A/c	Dr.	Rs. 70,000
Work-in-Progress A/c	Dr.	10,000
Finished Good stock A/c	Dr.	20,000
To Manufacturing Overhead A/c		Rs. 1,00,000

(Being under-absorbed overhead adjusted against cost of goods sold, W.I.P. and finished goods stock in proportion to their balances.)

(b) Budgeted hours in month (1,08,000÷12)	9,000
Actual hours available in a month (25 × 8 × 50)	10,000
Output expressed in standard hours (2000 × 2.5 + 1000 × 6)	11,000

$$\text{Standard Capacity (Usage) Ratio} = \frac{\text{Actual available hours}}{\text{Max. number of hours as per Budget}} \times 100$$

$$= \frac{10,000}{9,000} \times 100 = 111\%$$

$$\begin{aligned}\text{Activity Ratio} &= \frac{\text{Actual output in standard hours}}{\text{Budgeted output in standard hours}} \times 100 \\ &= \frac{11,000}{9,000} \times 100 = 122\%\end{aligned}$$

$$\begin{aligned}\text{Efficiency Ratio} &= \frac{\text{Output expressed in standard hours}}{\text{Actual hours spent producing that output}} \times 100 \\ &= \frac{11,000}{10,000} \times 100 = 110\%\end{aligned}$$

Problem 167. (Cost Sheet—Cost Estimate for Sales Department). The following budgeted cost information are available from the records of a manufacturing concern : (Rs./lakhs)

Direct Materials		61.20
Direct Wages :		
Rolling Shop (1,20,000 hours)	6.00	
Milling Shop (2,40,00 hours)	<u>14.40</u>	20.40
Works Overheads (Allocation on Labour Hours)		
Rolling Shop	9.60	
Milling Shop	<u>28.80</u>	38.40
Administration Overheads		24.00
Selling Overheads		28.80
Distribution Overheads		14.40

The concern follows absorption method of costing. On the basis of above data, prepare a Schedule of Overhead Rates. The Sales Division of the concern requires a Cost Estimate for a product for which following information are available :

Direct Materials	:	Materials X 120 kg.	@ Rs. 30 per kg.
		Materials Y 72 kg.	@ Rs. 55 per kg.
Direct Labour	:	Rolling Shop 40 hours	@ Rs. 6 per hour
		Milling Shop 70 hours	@ Rs. 5 per hour

You are required to work out the Cost Estimate showing cost per unit using the above information and the overhead rates so computed.

Statement showing the budgeted cost for the month

Solution :

		<i>Rs./lakhs</i>
Direct Materials		61.20
Direct wages :		
Rolling Shop (1,20,000 × Rs. 5) =	<i>Rs./lakh</i>	6.00
Milling Shop (2,40,000 × Rs. 6) =	<u>14.40</u>	<u>20.40</u>
Prime Cost		81.60
Works Overheads		
Rolling Shop (1,20,000 × Rs. 8) =	<i>Rs./lakh</i>	9.60
Milling Shop (2,40,000 × Rs. 12) =	<u>28.80</u>	<u>38.40</u>

Works cost	120.00
Administrative overhead (20% of works overhead)	24.00
Cost of production	<u>144.00</u>
Selling and distribution overhead (30% of cost of production)	<u>43.20</u>
Cost of sales	187.20

Cost Estimate for the Sale Division

Rs. per kg.

Direct Material		
X (120 × Rs. 30)	3600	
Y (72 × 55)	<u>3960</u>	7,560
Direct Labour		
Rolling Shop (40 × 6)	240	
Milling Shop (70 × 5)	<u>350</u>	<u>590</u>
Prime cost		8,150
Works overhead		
Rolling Shop (40 × 8)	320	
Milling Shop (70 × 12)	<u>840</u>	<u>1,160</u>
Works cost		9,310
Admn. overhead (20% of works cost)		
Cost of production		<u>1,862</u>
Selling and distribution (30% of cost of production)		<u>11,172</u>
Cost of sales		<u>3,352</u>
		14,524

Problem 168 (Equivalent Production – Average Method)

(a) Distinguish between Job Costing and Process Costing

(b) The in-process inventory in process No. 2 at the beginning of a period was valued at Rs. 2,950/- made up of Rs. 1,400/- towards materials, Rs. 1,000/- towards labour and Rs. 550/- towards overheads for 100 units. The value added during the period was Rs. 53,600/- towards an introduction of 4,100 units from the previous process besides Rs. 40,800/- towards labour and Rs. 19,400/- towards overheads. Out of 3,600 units completed 3,300 units were transferred to the next process leaving the balance in stock. 400 units were held back in process with half completion towards labour and overheads while 200 units were loss in processing considered normal and hence should be borne by the entire inventory. Prepare a cost of production statement using average cost basis.

Solution (a) Please refer to "Advanced Cost and Management Accounting—Text" by Saxena and Vashist

**(b) Statement of Equivalent Production
(Average Method)**

Input		Output		Equivalent Production			
Particulars	Units	Particulars	Units	Material		Labour & Overhead	
				Units	%	Units	%
Opening WIP	100	Loss on work done	200	—	—	—	—
New units introduced	4,100	Finished goods transferred to next process	3,300	3,300	100	3,300	100
		Closing stock of F.G.	300	300	100	300	100
		Closing stock of WIP	400	400	100	200	50
	4200		4,200	4,000		3,800	

Statement of cost for each element

Elements of cost	Cost of opening WIP	Cost in Process	Total cost	Equivalent units	Cost per unit
Material	Rs. 1,400	Rs. 53,600	Rs. 55,000	4000	Rs. 13.75
Labour	1,000	40,800	41,800	3,800	11.00
Overhead	550	19,400	19,950	3,800	5.25
	2,950	1,13,800	1,16,750		30.00

Statement of Apportionment of Cost

Items	Elements	Equivalent Units	Cost per Unit	Cost	Total Cost Rs
Units completed and transferred to Process 3	Material	3300	Rs. 13.75	Rs. 45,375	99,000
	Labour	3300	11.00	36,300	
	Overhead	3300	5.25	17,325	
Units completed and kept in closing stock of the process	Material	300	Rs. 13.75	Rs. 4,125	9,000
	Labour	300	11.00	3,300	
	Overhead	300	5.25	1,575	
Partly finished units in closing Stock	Material	400	13.75	5,500	8,750
	Labour	200	11.00	2,200	
	Overhead	200	5.25	1,050	
					1,16,750

* This is the value added during the period excluding labour and overhead. Since value added is the difference between the revenue and cost of bought in materials and services, this has been treated as material so far as this process is concerned.

Problem 169. (Flexible Budget including Export Pricing). A company is at present working at 90% of its capacity and producing 13,500 units per annum. It operates a flexible budgetary control system. The

following figures (excluding material and labour cost) are obtained from its budget :

	90%	100%
(a) Sales	Rs. 15,00,000	Rs. 16,00,000
(b) Fixed Expenses	3,00,500	3,00,500
(c) Semi-Fixed Expenses	97,500	1,00,500
(d) Variable Expenses	1,42,000	1,49,500

Material and Labour Cost per unit are constant under present conditions. Profit margin is 10% at 90% capacity :

- You are required to determine the cost of producing an additional 1,500 units.
- What would you recommend for an export price for these 1,500 units taking into account that overseas prices are much lower than indigenous prices ?

Solution

(a) Statement showing cost of producing an additional 1,500 units:

	90%	100%	Differential cost
Production (in units)	13,500	15,000	1,500
Material & Labour @ Rs. 60*	8,10,000	9,00,000	Rs. 90,000
Fixed Expenses	3,00,500	3,00,500	—
Semi Fixed Expenses	97,500	1,00,500	3,000
Variable Expenses	1,42,000	1,49,500	7,500
Total Cost	13,50,000	14,50,500	1,00,500

Therefore, the cost of producing additional 1,500 units is Rs. 1,00,500.

(b) Company must recover this differential cost of Rs. 1,00,500 i.e., any price more than Rs. 67.00 should be acceptable to the company. This price will facilitate entry in foreign market. Besides exporters are entitled many incentives like cash subsidy and duty drawback etc.

Sales	Rs. 15,00,000
Less : Profit 10% of sales	<u>1,50,000</u>
Total cost	<u>13,50,000</u>
Less : Cost other than material and labour :	
Fixed Expenses	3,00,500
Semi Fixed Expenses	97,500
Variable Expenses	<u>1,42,000</u>
Material & Labour cost	<u><u>8,10,000</u></u>

or Rs. 8,10,000 ÷ 13,500 = Rs. 60/-

Note-1-- Profit margin is assumed to be 10% of sales

* Calculating Material and Labour at 90% capacity

Note-2— Variable Expenses given at 100% capacity do not bear constant relationship per unit. It means there is some fixed cost element or there is variation in price or usage :

Note-3— For quotation, price can be calculated on variable cost as follows:

Material cost per unit = Rs. 60.00

Variable cost per unit (included in semi-fixed expenses)

(Rs 1,00,500—Rs. 97,500) ÷ 1,500 = 2.00

Variable expenses per unit

(Rs. 1,49,500 – Rs. 1,42,000) ÷ 1,500 = 5.00

67.00

Problem 170. (Profit-Volume Chart). (a) From the data below you are required to present on graph paper a profit volume (P/V) graph to show the expected company performance based on the budget for one year

(Rs. '000)

Sales	600
Marginal Cost	350
Fixed Cost	150

Determine the Break-Even Point and the Margin of Safety.

(b) Discuss briefly the limitations of a profit volume graph.

Solution

For preparation of profit volume chart given data can be summarised as follows :

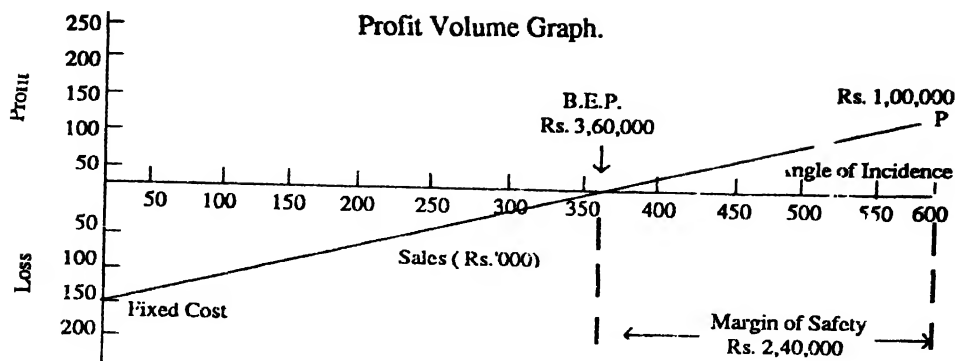
Sales	Rs. 600.00
Marginal cost	<u>350.00</u>
Contribution	250.00
Fixed cost	<u>150.00</u>
Profit	<u>100.00</u>

$$\text{B.E. Point} = \frac{\text{Rs. 150,000}}{250,000} \times 6,00,000 = \text{Rs. 3,60,000}$$

$$\text{Margin of Safety} = \text{Rs. 6,00,000} - 3,60,000 = \text{Rs. 2,40,000}$$

This is shown by the P/V graph :

(b) Please refer to "Advanced Cost and Management Accounting — Text" by V.K. Saxena and C.D. Vashist.



Problem 171. (Flexible Budget). A factory is currently running at 50% capacity and produces 5,000 units at a cost of Rs. 90/- per unit as per details below :

Material	Rs. 50
Labour	15
Factory Overheads	15 (Rs. 6/- fixed)
Administrative Overheads	10 (Rs. 5/- fixed)

The current selling price is Rs. 100/- per unit.

At 60% working, material cost per unit increases by 2% and selling price per unit falls by 2%.

At 80% working, material cost per unit increases by 5% and selling price per unit falls by 5%.

Estimate profits of the factory at 60% and 80% working and offer your comments.

Solution	Flexible Budget		
Capacity	50%	60%	80%
Production (units)	5,000	6,000	8,000
	<i>Rs. per unit</i>		
Material	Rs. 50	Rs. 51	Rs. 52.50
Labour	15	15	15.00
Variable Overheads			
Factory	9	9	9.00
Administration	5	5	5.00
Variable costs per unit.	79	80	81.50
Total variable cost	Rs. 3,95,000	Rs. 4,80,000	Rs. 6,52,000
Fixed Overheads			
Factory	30,000	30,000	30,000
Administration	25,000	25,000	25,000
Total cost of production	4,50,000	5,35,000	7,07,000
Selling price per unit @ Rs. 100	5,00,000	5,88,000	7,60,000
Profit	50,000	53,000	53,000

Comments : It is clear from above workings that profit has gone up by Rs. 3,000 by utilization of additional 10% capacity despite given changes. However, by increasing the capacity utilization from 60% to 80% the profit gets neutralised by increase in cost and decrease in selling price.

Problem 172. (Material Variances). XYZ company manufactures a product ABC by mixing three raw materials. For every 100 kg. of ABC, 125 kg of raw materials are used. In April 1990, there was an output of 5,600 kg of ABC. The standard and actual particulars of April 1990 are as follows :

Raw Material	Standard		Actual	
	Mix	Price	Mix	Price
	%	Rs. Per kg	%	Rs. Per kg
Raw Material I	50	40	60	42
Raw Material II	30	20	20	16
Raw Material III	20	10	20	12

Calculate all variances.

Solution

For Calculation of Variances

M₁—Actual cost of material used

	Mix %	Actual material used kg	Rate (Actual) Rs.	Amount Rs.
Raw Mat. I	60	4,200	42	1,76,400
Raw Mat. II	20	1,400	16	22,400
Raw Mat. III	20	<u>1,400</u>	12	<u>16,800</u>
		<u>7,000</u> kg		<u>2,15,600</u>

M₂—Standard Cost of Material used :

	Mix %	Mat. used (actual) (kg)	Rate (standard) (Rs.)	Amount Rs.
Raw Mat. I	60	4,200	40	1,68,000
Raw Mat. II	20	1,400	20	28,000
Raw Mat. III	20	<u>1,400</u>	10	<u>14,000</u>
		<u>7,000</u>		<u>2,10,000</u>

M₃—Standard cost of material used if it had been used in standard proportion

	Mix %	Material used (in standard proportion) kg.	Rate (standard)	Amount
Raw Mat I	50	3,500	40	Rs. 1,40,000
Raw Mat. II	30	2,100	20	42,000
Raw Mat. III	20	<u>1,400</u>	10	<u>14,000</u>
		<u>7,000</u>		<u>1,96,000</u>

M_4 —Standard Material cost of output.

Standard cost of 100 kg. of ABC

	(kg.)			
Raw Mat. I	62.50	×	Rs. 40	= Rs. 2,500
Raw Mat. II	37.50		Rs. 20	= 750
Raw Mat. III	<u>25.00</u>	×	Rs. 10	= <u>250</u>
	125 kg.			<u>3,500</u>
Less : Loss	25 kg.			
Output	<u>100 kg.</u>			

The standard cost of 5,600 kg. = 5,600 (3,500/100) = Rs. 1,96,000

Material Variance:

—Price = $M_1 - M_2$ = Rs. 2,15,600 – 2,10,000 = Rs. 5,600 (A)

—Mix = $M_2 - M_3$ = Rs. 2,10,000 – Rs. 1,96,000 = Rs. 14,000 (A)

—Yield $M_3 - M_4$ = Rs. 1,96,000 – Rs. 1,96,000 = NIL

—Usage = $M_2 - M_4$ = Rs. 2,10,000 – Rs. 1,96,000 = Rs. 14,000 (A)

—Cost = $M_1 - M_4$ = Rs. 2,15,600 – Rs. 1,96,000 = Rs. 19,600 (A)

Problem 173. (Apportionment of Joint Costs). In a process line of XY company three joint products are produced. For the month of May '90 the following data were available.

	L	M	N
Sales price per kg.	Rs. 5	Rs. 10	Rs. 20
Post-separation point costs	10,000	5,000	15,000
Output in kg.	2,500	1,000	1,500

Pre-separation point costs amounted to Rs. 20,000.

The joint products are manufactured in one common process, after which they are separated and may undergo further individual processing. The pre-separation point costs are apportioned to joint products according to weight. You are required to prepare a statement showing the estimated profit or loss for each product and in total.

Solution : Pre-separation cost = Rs. 20,000

(Apportion on weighted basis (25 : 10 : 15 or 5 : 2 : 3))

	L		M		N	
Production (in kgs.)	2,500		1,000		1,500	
	Total	Per unit	Total	Per unit	Total	Per unit
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Pre-separation cost	10,000	4.00	4,000	4.00	6,000	4.00
(5 : 2 : 3)						

* Input for 5,600 kg of output = 5,600 (125/100) = 7000 kg.

Post-separation cost	<u>10,000</u>	<u>4.00</u>	<u>5,000</u>	<u>5.00</u>	<u>15,000</u>	<u>10.00</u>
Total cost	20,000	8.00	9,000	9.00	21,000	14.00
Profit/Loss (balancing figure)	<u>(7,500)</u>	<u>(3.00)</u>	<u>1,000</u>	<u>1.00</u>	<u>9,000</u>	<u>6.00</u>
Sales Price	<u>12,500</u>	<u>5.00</u>	<u>10,000</u>	<u>10.00</u>	<u>30,000</u>	<u>20.00</u>

Problem 174. (Fallacies in the statement relating to operating/job costing). Indicate the fallacy in the undermentioned cases :

(a) The cost of running a hospital is Rs. 50 lakhs and the patients in a year total 20,000. The accountant proposes to charge Rs. 250 from each patient.

(b) In a motor repair garage, the cost for a job is worked out by adding the cost of parts used and the wages paid to the worker involved.

(c) 60,000 tonnes of coal is consumed at NTPC thermal power plant @ Rs. 600 per tonne every month. About 3,000 tonnes of coal ash is produced after burning of the coal. The accountant says that the coal used is 57,000 tonnes @ Rs. 600 or Rs. 342 lakhs.

(d) A telco-truck operator spends Rs. 10,000 in a month and hauls 500 tonnes, the distance involved being different from customer to customer. The accountant proposes to charge Rs. 25 (Rs. 5 to cover profit) per tonne.

Solution. (a) Charging a an overall rate of Rs. 250 per patient is not correct. In hospital costing, different rate for different departments such as outpatient, wards, specialist services and diagnostic department should be determined giving regard to behaviour of cost based on variability, patient-days, beds etc. Different rates will be determined for different departments.

(b) Charge for wages should be based on time spent by the worker on this job. Cost should also include a charge for overheads which will cover such indirect expenses such as rent, rates, supervision, insurance and depreciation of machinery.

(c) Charge should be Rs. 36 lakhs (6,000 tonnes × Rs. 600) *minus* recovery from saleable coal ash, if any. In case, additional expenses for removing the coal ash are to be incurred, the same will be added to the cost.

(d) The cost unit should be tonne-kilometer. In this question, vital information for linking weight with distance

I.C.W.A. Final June 1990

Problem 175 (More than one key factor). An agriculturist has 480 hectares of land on which he grows potatoes, tomatoes, peas and carrots. Out of the total area of land, 340 hectares are suitable for all the four vegetables but the remaining 140 hectares of land are suitable only for growing peas and carrots. Labour for all kinds of farm work is available in plenty.

The market requirement is that all the four types of vegetables must be produced with a minimum of 5,000 boxes of any one variety. The farmer has decided that the area devoted to any crop should be in terms of complete hectares and not in fractions of a hectare. The only other limitation is that not more than 1,13,750 boxes of any one vegetable should be produced.

The relevant data concerning production, market prices and costs are as under :

	Potatoes	Peas	Carrots	Tomatoes
<i>Annual yield :</i>				
Boxes per hectare	350	100	70	180
	Rs.	Rs.	Rs.	Rs.
<i>Costs :</i>				
Direct Material per hectare	952	432	384	624
<i>Direct Labour :</i>				
Growing per hectare	1792	1216	744	1056
Harvesting and Packing per box	7.20	6.56	8.80	10.40
Transport per box	10.40	10.40	8.00	19.20
Market price per box	30.76	31.74	36.80	44.55
<i>Fixed expenses per annum :</i>			Rs.	
Growing			1,24,000	
Harvesting			75,000	
Transport			75,000	
General Administration			1,50,000	

It is possible to make the land presently suitable for peas and carrots, viable for growing potatoes and tomatoes if certain land development work is undertaken. This work will involve a capital expenditure of Rs. 6,000 per hectare which a Bank is prepared to finance at the rate of interest of 15% p.a. If such improvement is undertaken, the harvesting cost of the entire crop of tomatoes will decrease on an average by Rs. 2.60 per box.

Required :

- Calculate, within the given constraints, the area to be cultivated in respect of each crop to achieve the largest total profit and the amount of such total profit before land development work is undertaken.
- Assuming that the other constraints continue, advise the grower whether the land development scheme should be undertaken and if so the maximum total profit that would be achieved after the said development scheme is undertaken.

Solution

- (i) Calculation of area to be cultivated in respect of each crop to achieve the largest total profit

Available information :

Land available for all four vegetables	340 Hectares
Land available for peas and carrots	140 "
Total land available	<u>480 "</u>

Minimum requirement of each variety 500 boxes

Maximum requirement of each variety 1,13,750 boxes

Statement showing the contribution per hectare of each vegetable

	Potatoes	Peas	Carrots	Tomatoes
Boxes per hectare	350	100	70	180
(a) Market price	Rs. 30-76	Rs. 31-74	Rs. 36-80	Rs. 44-55
(b) Variable Costs :				
Direct Material	2-72*	4-32	5-49	Rs. 3-47
Labour—Growing	5-12*	12-16	10-63	5-87
—Harvesting & Packing	7-20	6-56	8-80	10-40
Transport per box	10-40	10-40	8-00	19-20
Total Variable Costs	<u>25-44</u>	<u>33-44</u>	<u>32-92</u>	<u>38-94</u>
(c) Contribution per box (a)–(b)	5-32	(1-70)	3-88	5-61
Contribution per hectare				
(c) × Boxes per hectare	1,862	(170)	271-60	1,009-80
Ranking	I	IV	III	II

*Cost per hectare ÷ Boxes per hectare

Best cultivation Plan : From 140 hectares for peas and carrots :

Peas : Minimum 5,000 boxes = $5000 \div 100 = 50$ hectares.

Carrots : Balance land 140 hectares – 50 hectares = 90 hectares

From 340 hectares for all four vegetables :

Tomatoes : Minimum 5000 boxes = $5000 \div 180 = 28$ hectares

(In terms of complete hectares)

Potatoes : Balance of land, i.e., $340 - 28 = 312$ hectares

Area to be Cultivated for each variety and total contribution

	Potatoes	Peas	Carrots	Tomatoes
Hectares	312	50	90	28
Contribution per hectare	Rs. 1862	(170)	271-60	1009-80
Contribution	Rs. 5,80,944	(8,500)	24,444	28,274-40
Total Contribution	Rs. 6,25,162-40			
Less : Fixed Expenses	4,24,000-00			
Profit	<u>20,1,162-40</u>			

(ii) Analysis to show whether land development should be undertaken

Carrot yields a lower contribution per hectare than Potatoes and Tomatoes, but it is grown in excess of the requirement of 5,000 boxes (or 72 hectares i.e.

5000 boxes + 70). Therefore, 18 hectares *i.e.*, 90 hectare – 72 hectares can be made available for Potatoes and Tomatoes by land improvement.

After land improvement the contribution per hectare of tomatoes will be as follows :

Present contribution per hectare	= Rs. 1,009.80
● Saving per hectare after land improvement	= Rs. 468.00
—Rs. 2.60 × 180 boxes	<u>1477.80</u>

Allocation of 18 hectares available

<i>Crop</i>	<i>Max. Sales (Boxes)</i>	<i>Present Production (Boxes)</i>	<i>Addl. Reqd. 'Boxes)</i>	<i>Yield per hectare (boxes)</i>	<i>Additional hectares to be allotted</i>
Potatoes	1,13,750	1,09,200*	4550	350	13
Tomatoes	1,13,750	5,000	900	180	5@

*312 hectares × 350 boxes = 1,09,200 ;

@ Balance land

Profit by revised Cultivation Plan

	<i>Potatoes</i>	<i>Peas</i>	<i>Carrots</i>	<i>Tomatoes</i>	<i>Total</i>
<i>Hectare</i>	325	50	72	33	480
Contribution per hectare	Rs. 1,862	(170)	271.60	1,477.80	
Total Contribution	Rs. 6,05,150	(8,500)	19,555.20	48,767.40	6,64,972.60
Less : Fixed Cost (revised)*					<u>4,40,200.00</u>
Profit					<u>2,24,772.60</u>

*Capital Expenditure = 18 hectares × 6,000 = Rs. 1,08,000

Interest (108000 × 0.15) = Rs. 16,200

Existing fixed expenses = 4,24,000

4,40,200

Conclusion : Since the profit after land development is greater, the company should implement the proposal to develop 18 hectares of land.

Problem 176 (Introduction of a New Product—Relevant Costing). A company manufacturing several products for regular sales, has conducted a market survey at a cost of Rs. 1,00,000 to introduce a new product NP. The market survey suggests that there is a demand for the sale of 1,00,000 units of NP at Rs. 18 each for one year.

The following information has been furnished by the Company :

(i) **Raw Materials :** Each article of NP requires one unit of each of the three types of the raw materials namely A, B and C. Material 'A' is in regular use of the Company and the stocks are replaced as and when exhausted. Material 'B' is not in regular use of the Company but as a result of overbuying in an earlier contract, the Company at present holds a stock of 60,000 units. Material 'C' is used only in NP and hence the Company has to purchase the same as per the requirement of production of the new product.

The data relating to the three items of raw materials are as under :

Raw Material	Current Stock (Units)	Original Cost.	Cost per unit of raw material	
			Current Replacement Cost	Current Resale Cost
A	1,00,000	Rs. 2.00	Rs. 2.50	Rs. 1.75
B	60,000	3.50	3.00	1.00
C	—	—	6.00	5.00

(ii) *Direct Labour* : NP requires for each article :

Skilled labour 0.25 hour at Rs. 3 per hour and unskilled labour 2 hours at Rs. 2 per hour.

Due to shortage of skilled labour, the Company has, in the event of deciding to take up the production of NP, to divert the skilled labour from some other product which earns a contribution of Rs. 2 per hour of skilled labour. The Company has a surplus of 3,00,000 hours of unskilled labour for which payment is being made on time basis as per contract and it is not possible to terminate these surplus workers.

(iii) *Additional staff required for the manufacture of NP* :

One Foreman at Rs. 36,000 p.a.

One Supervisor at Rs. 24,000 p.a.

(iv) *Machines* : Two machines namely Machine Type 'P' and Machine Type 'Q' are required to produce NP. Machine Type 'P' is in regular use on other products also and Machine Type 'Q' is now idle. If NP is not produced Machine Type 'Q' can be sold immediately. The relevant data relating to each type of machine are as under :

	At the start of the year	At the close of the year
Type 'P' Replacement Cost	Rs. 1,60,000	Rs. 1,30,000
Resale value	1,20,000	94,000
Type 'Q' Replacement Cost	26,000	18,000
Resale value	22,000	17,000

The Company charges depreciation on straight line basis.

(v) *Overheads* :

Fixed Overheads of the Company Rs. 18,00,000 per annum.

Variable Overheads Rs. 1.50 per unit of the new product NP.

Using the concept of relevancy of costs, prepare a cost sheet to show the cost per unit of the new product NP. Substantiate the figures with necessary explanation.

Solution : *Cost sheet showing Cost per unit of product NP Costs*
For 1,00,000 units Rs. For one unit (Rs.)

Direct Materials :

A	1,00,000 × Rs. 2.50	2,50,000
B	60,000 × Re. 1.00	60,000
	40,000 × Rs. 3.00	1,20,000
C	1,00,000 × Rs. 6.00	6,00,000
		<u>10,30,000</u>

Direct Labour :

Skilled Workers 25,000 hrs × Rs. 3-00	75,000	
Opportunity cost of skilled workers 25,000 hrs × Rs. 2-00	50,000	
Unskilled workers (payment will be made, whether decision is taken or not and hence irrelevant)	<u>1,25,000</u>	1-25

Variable Overhead :

(1,00,000 units × Rs. 1-50)	1,50,000	1-50
-----------------------------	----------	------

Fixed Overheads :

- (i) Fixed Overheads of Rs. 18,00,000 p.a.
will be there irrespective of this
decision. Hence irrelevant

(ii) Additional Overheads		
Foreman	36,000	
Supervisor	24,000	
	<u>60,000</u>	0-60

Depreciation

Type P	30,000	
Type Q	5,000	
	<u>35,000</u>	0-35

Total Costs	14,00,000	14-00
Sales	18,00,000	18-00
Profit	<u>4,00,000</u>	<u>4-00</u>

Workings**Direct Materials**

A—It is in regular use and hence replacement cost will be used

B—Total requirement 1,00,000 units

60,000 units – Opportunity cost Re. 1-00 each

40,000 units -- Purchase price of Re. 3-00 each

Direct Labour

Skilled Labour — 1,00,000 units @ Re 0-25 = Rs. 25,000

Opportunity cost — 25,000 × Rs. 2 = Rs. 50,000

Unskilled labour — Available in excess and is being paid already and hence irrelevant

Additional Staff

Foreman	Rs. 36,000 p.a.	} Relevant Cost
Supervisor	Rs. 24,000 p.a.	

Variable Overhead — Rs. 1-50 per unit relevant

Fixed Cost — Irrelevant

Depreciation

Type P — Since it is used on other products in regular use, replacement cost is relevant.

Type Q — Since it can be sold, if not used, resale value is relevant, i.e., Rs. 22,000 – 17,000 = Rs. 5,000

Market survey cost — It is sunk cost and hence irrelevant.

Problem 177 (Responsibility Accounting). A production department of a large manufacturing organisation has furnished the following data for May 1990 :

	<i>Budget</i>	<i>Actual</i>
Direct Materials	Rs. 4,00,000	Rs. 5,10,000
Direct Wages	2,50,000	3,25,000
Repairs and Maintenance (Rs. 1,00,000 Fixed)	2,00,000	2,20,000
Supervision (Fixed)	1,00,000	1,10,000
Consumable Stores (Variable)	75,000	95,000
Factory Rent (Fixed)	50,000	50,000
Depreciation (Fixed)	1,00,000	1,00,000
Tools (Variable)	25,000	30,000
Power and Fuel (Variable)	1,50,000	1,80,000
Administration (Fixed)	2,50,000	2,65,000

The department has 50 identical machines. During May 1990, the budgeted and actual production of the department are 10,000 and 12,500 units respectively. However, if the department was closed and the machine production services were hired from outside, the cost of hiring the services of similar machines would be Rs. 150 per unit.

(i) You are required to present reports showing the evaluation of the performance of the department based on the concept of (a) Cost Centre (b) Profit Centre and (c) Responsibility Centre.

(ii) It is felt that since the total budgeted cost of production per unit is greater than the cost of hired services, the possibility of closing down the department and use of hired services should be explored if the budgeted production cannot be increased in June 1990. Assuming that the budgeted expenses and level of output planned for May 1990 will hold good for June 1990 also, calculate the volume of output required to justify the continuance of the department.

Solution :

(i) Reports showing the evaluation of the performance of the department on different responsibility concepts

(a) *Cost Centre basis*

	<i>Budget</i>	<i>Allowed Cost</i>	<i>Actual</i>
Output (Units)	10,000	12,500	12,500
<i>Variable</i>			
Direct Material	Rs. 4,00,000	Rs. 5,00,000	Rs. 5,10,000
Direct Wages	2,50,000	3,12,500	3,25,000
Repairs and Maintenance	1,00,000	1,25,000	1,20,000
Consumable Stores	75,000	93,750	95,000
Tools	25,000	31,250	30,000
Power and Fuel	1,50,000	1,87,500	1,80,000
Total Variable Cost	10,00,000	12,50,000	12,60,000

Fixed

Repairs and Maintenance	1,00,000	1,00,000	1,00,000
Supervision	1,00,000	1,00,000	1,10,000
Factory Rent	50,000	50,000	50,000
Depreciation	1,00,000	1,00,000	1,00,000
Administration	2,50,000	2,50,000	2,65,000
Total Fixed Cost	6,00,000	6,00,000	6,25,000
Total Cost	16,00,000	18,50,000	18,85,000

Expense Variance = Rs. 18,50,000 – Rs. 18,85,000 = Rs. 35,000 (A)

Volume Variance = [(6,00,000 + 10,000) × 12,500] – Rs. 6,00,000
= Rs. 1,50,000 (F)

Total Overhead Variance = Rs. 35,000 (A) + Rs. 1,50,000 (F)
= Rs. 1,15,000 (F)

Check

Actual Overhead = Rs. 18,85,000

Standard or Budgeted Overhead

(16,00,000 + 10,000) × 12,500 = 20,00,000

Total Overhead Variance 1,15,000 (F)

(b) Profit Centre Basis

Cost of Production on hired machine services (12,500 × 150) Rs. 18,75,000

Actual 1,885,000

Profit Variance 10,000

*(c) Responsibility Centre Basis**Controllable*

	<i>Budget</i>	<i>Actual</i>	<i>Variance</i>
Direct material	Rs. 5,00,000	Rs. 5,10,000	Rs. 10,000 (A)
Direct Wages	3,12,500	3,25,000	12,500 (A)
Repairs and Maintenance	2,25,000	2,20,000	5,000 (F)
Consumable Stores	93,750	95,000	1,250 (A)
Tools	31,250	30,000	1,250 (F)
Power and Fuel	1,87,500	1,80,000	7,500 (F)
Supervision	1,00,000	1,10,000	10,000 (A)
	<u>14,50,000</u>	<u>14,70,000</u>	<u>20,000 (A)</u>

Non Controllable

	<i>Budget</i>	<i>Actual</i>	<i>Variance</i>
Factory Rent	50,000	50,000	—
Depreciation	1,00,000	1,00,000	—
Administration	2,50,000	2,65,000	15,000 (A)
	<u>4,00,000</u>	<u>4,15,000</u>	<u>15,000 (A)</u>

(iii) Volume of Output required to justify the continuance of 'Department'

Variable Cost of making on own machine as per budget

= Rs. 10,00,000 + 10,000 = Rs. 100

Variable Cost of making on hired services = Rs. 150
 Savings if manufactured on own machine = Rs. 150 – Rs. 100 = Rs. 50
 Fixed Cost = Rs. 60,00,000
 Minimum number of units to justify
 continuance of the Deptt. = Rs. 6,00,000 ÷ Rs. 50 = 12,000 units

Note: In cost centre approach, reasons or difference between actual cost and budgeted cost allowed for production should be explained. In profit centre approach, profit variance should be highlighted. In the case of responsibility centre approach, variance should be reported as controllable or non-controllable.

Problem 178 (Return on Investment Pricing). PH Ltd., manufactures product 'S' in departments A and B which also manufactures other products using the same machines. The particulars per unit of the Product 'S' are as under :

Direct Material : M—8 kg. at Rs. 3 per kg. used in Dept. A

P—4 kg. at Rs. 5 per kg. used in Dept. B

Direct Labour : 2 hours at Rs. 12 per hour in Dept. A

3 hours at Rs. 10 per hour in Dept. B

Overheads :

	<i>Dept. A</i>	<i>Dept. B</i>
Method of Recovery	Direct Labour Hours	Direct Labour Hours

Overhead Rates

Fixed	Rs. 6.00 per hour	Rs. 3.00 per hour
Variable	Rs. 5.00 per hour	Rs. 2.00 per hour
Value of Plant & Machinery	Rs. 16 lakhs	Rs. 8 lakhs

Variable selling and distribution overheads relating to Product 'S' amount to Rs. 20,000 per month. The product requires a working capital of Rs. 3,00,000 at the target volume of 1,000 units per month occupying 25% of the practical capacity.

Required :

- (i) Using the return on investment pricing formula, find the price of Product 'S' to yield a contribution to cover 24% rate of return of investment
- (ii) If Product 'S' is a well established product in the market, what should be the basis for fixation of price. Set the minimum price on that basis.
- (iii) If product 'S' is a new product about to be launched in the market, what should be the basis for fixation of price. Set the minimum price on that basis.

Solution :

PH Ltd.

**Statement showing Price of Product 'S' based on
different hypothesis.**

- (i) *Based on return on investment*

Direct material

M—8 kg. × Rs. 3	Rs. 24.00
P—4 kg. × Rs. 5	20.00

Direct Labour

Dept. A—2 hrs. × Rs. 12	24.00
Dept. B—3 hrs. × Rs. 10	30.00

Variable Overheads

Dept. A—2 hrs. × Rs. 5	10.00
Dept. B—3 hrs. × Rs. 2	6.00
Selling and Distribution Overhead (Rs. 20,000 ÷ 1,000)	20.00
Total Variable Cost per unit	134.00

Total hours required for a target of 1000 units of product 'S'

Dept A—1000 × 2 hrs.	= 2,000 hrs.
Dept B—1000 × 3 hrs.	= 3,000 hrs.
	<u>5,000 hrs.</u>

5000 hrs represent 25% capacity

∴ Total Capacity	= 20,000 hrs. p.m.
	= 2,40,000 hrs. per annum

Fixed Capital Employed in both the Departments

Dept A	Rs. 16,00,000
Dept B	8,00,000
	<u>24,00,000</u>

24% return required on an investment of Rs. 24,00,000 = $24,00,000 \times 0.24$
= Rs. 5,76,000

∴ Contribution required per hour = $\text{Rs. } 5,76,000 \div 2,40,000 = \text{Rs. } 2.40$
for using machines in Dept. A and B

Working capital = Rs. 3,00,000

24% returns required = $\text{Rs. } 3,00,000 \times 0.24 = \text{Rs. } 72,000$

Contribution required per unit = $\text{Rs. } 72,000 \div 12,000 \text{ units} = \text{Rs. } 6$

Total Contribution required :

	<i>Rs. per unit</i>
To cover fixed cost for usage of machinery = 5 hrs. × Rs. 2.40	= 12.00
To cover working capital	= 6.00
	<u>18.00</u>

∴ Price of Product \$ = Variable cost + Contribution required
= Rs. 134 + Rs. 18 = Rs. 152 per unit

(ii) Basis that product is well established .

Variable cost = Rs. 134

Fixed Cost :

Dept. A—2 hrs. × 6	12
Dept. B—3 hrs. × 3	9
	<u>155</u>

If the product is well established, the total cost (absorption cost basis) should form the basis for price fixation. Minimum price = Rs. 155 per unit.

(iii) Basis that product is new about to be launched in market

If it is a newly introduced product, variable cost should form the basis for price fixation.

Minimum price is Rs. 134 per unit, *i.e.*, on marginal cost basis

Note : (i) Fixed charged recovery (return on investment basis) is based on the usage. Full capacity is not being used by product 'S' and Departments are manufacturing other products using the same machine.

(ii) Working capital of Rs. 3,00,000 is required for 1000 units of 'S' per month. Therefore return expected has been spread over 1000 units p.m.

Problem 179 (Goal congruent transfer price). A large Company is organised into several manufacturing divisions. The policy of the Company is to allow the Divisional Managers to choose their sources of supply and when buying from or selling to sister divisions, to negotiate the prices just as they will for outside purchase or sales

Division X buys all of its requirements of its main raw material R from Division Y. The full manufacturing cost of R for Division Y is Rs. 88 per kg. at normal volume.

Till recently, Division Y was willing to supply R to Division X at a transfer price of Rs. 80 per kg. The incremental cost of R for Division Y is Rs. 76 per kg. Since Division Y is now operating at its full capacity, it is unable to meet the outside customers' demand for R at its market price of Rs. 100 per kg. Division Y therefore threatened to cut off supplies to Division X unless the latter agrees to pay the market price for R.

Division X is resisting the pressure because its budget based on the consumption of 1,00,000 kg. per month at a price of Rs. 80 per kg. is expected to yield a profit of Rs. 25,00,000 per month and so a price increase to Rs. 100 per kg. will bring the Division X close to break even point.

Division X has even found an outside source for a substitute material at a price of Rs. 95 per kg. Although the substitute material is slightly different from R, it would meet the needs of Division X. Alternatively, Division X is prepared to pay Division Y even the manufacturing cost of Rs. 88 per kg.

Required :

- (i) Using each of the transfer price of Rs. 80, Rs. 88, Rs. 95, and Rs. 100, show with supporting calculations, the financial results as projected by the :
 - (a) Manager of Division X
 - (b) Manager of Division Y
 - (c) Company.
- (ii) Comment on the effect of each transfer price on the performance of the Managers of Division X and Division Y.
- (iii) If you were to make a decision in the matter without regard to the views of the individual Divisional Managers, where should Division X obtain its materials from and at what price.

Solution : (i) Statement showing the impact of different transfer prices on divisional profit

(a) Transfer price Rs. 80

Division X	Division Y	For the Company
Budgeted Profit on this price = Rs. 25,00,000	Sales 1,00,000 × Rs. 80 Rs. 80,00,000	X Division = 25,00,000
	V. Cost : 1,00,000 × 76 = 76,00,000	Y Division = 4,00,000
	Profit 4,00,000	Profit of Company 29,00,000

(b) Transfer price of Rs. 88

Division X	Division Y	For the Company
Budgeted Profit = Rs. 25,00,000	Sales 1,00,000 × Rs. 88 = 88,00,000	Profit from : X Rs. 17,00,000
Less Additional Cost = 1,00,000 × Rs. 8 = 8,00,000	V. Cost 1,00,000 × Rs. 76 = 76,00,000	Y 12,00,000
Profit of X 17,00,000	Profit of Y 12,00,000	Profit for the Co. 29,00,000

(c) Transfer for Price of Rs 95

Division X	Division Y	For the Company
Budgeted Profit = Rs. 25,00,000	Sales 1,00,000 × Rs. 95 = Rs. 95,00,000	Profit from : X 10,00,000
Less Additional Cost 1,00,000 × (Rs. 95 - 80) = 15,00,000	V. Cost 1,00,000 × Rs. 76 = 76,00,000	Y 19,00,000
Profit 10,00,000	Profit 19,00,000	Profit for the Co. 29,00,000

(d) Transfer Price of Rs. 100

Division X	Division Y	For the Company
Budgeted Profit = Rs. 25,00,000	Sales 1,00,000 × Rs. 100 = Rs. 1,00,00,000	Profit from : X Rs. 5,00,000
Less Addl. Cost 1,00,000 × (Rs. 100 - 80) = 20,00,000	Less V. Cost 1,00,000 × Rs. 76 76,00,000	Y 24,00,000
Profit 5,00,000	Profit 24,00,000	Profit for the Co. 29,00,000

(ii) Comment on different Prices

- (a) Transfer price of Rs. 80 gives good incentive to Manager of 'X' Division, but it discourages the Manager of 'Y' Division, because he

can sell outside at Rs. 100 and thus he can show better profit if he is allowed to sell outside.

- (b) Transfer price of Rs 88 reduces the profits of Division 'X' and boosts the performance of Division Y in comparison to existing arrangement. The decision neither increases not decreases the company's profits.
- (c) Transfer price of Rs. 95 further reduces the profit of Division 'X' and correspondingly improves the profits of Division Y. Company's profits again neither increases not decreases due to this decision.
- (d) Price of Rs. 100 puts Manager of X Division to very disadvantageous position, because X is able to get the material from outside source at Rs. 95. Therefore, at this price profit of Division 'X' are unnecessarily decreased by Rs. 5,00,000, i.e., $1,00,000 \times (\text{Rs. } 100 - \text{Rs. } 95.00)$. Since Y can get Rs. 100 from outside customers, this price means loss of company's profit by Rs. 5,00,000.

(iii) *Decision in the matter.* The transfer price must motivate the concerned divisional managers maintaining the divisional autonomy. The best course will be :

- (a) X Division should buy the material R from outside source at price of Rs. 95.
- (b) Y Division should sell entire quantity of R to outside consumer at Rs. 100.

The decision will maximise the company profits, as in clear from the following analysis :

Division X		Division Y	
Budgeted Profit	= Rs. 25,00,000	Sales	$1,00,000 \times \text{Rs. } 100$
Less Additional Cost			= Rs 1,00,00,000
$1,00,000 \times (\text{Rs. } 95 - \text{Rs. } 80) =$		Less V. Cost	
	15,00,000	$1,00,000 \times \text{Rs. } 76 =$	76,00,000
	<u>10,00,000</u>		<u>24,00,000</u>

Company's Profit = Rs. 10,00,000 + Rs. 24,00,000 = Rs. 34,00,000.

Problem 180 (Combined P/V Ratio and discontinuance of a Product). A Company manufactures two products namely Product A and Product B. The price and cost data are as under for 19 X 1 :

	A	B
Selling Price	Rs. 200	Rs. 100
Variable Costs	120	40

Total fixed costs Rs. 23,00,000 per annum.

The Company sells the two products in the sales value ratio of 7 : 3 and is operating at a margin of safety of 20%.

During the next year, 19 X 2, the Company anticipates that the variable costs of Products A and B will go up by 5% and $2\frac{1}{2}\%$ respectively. The fixed expenses will also go up by 5%.

Required :

- (i) Find the quantity of Products A and B sold in 19 X 1.
 (ii) Evaluate the following proposals which are under consideration for implementation in 19 X 2 :

- (a) If the Company desires to sell the same quantity of Product A as in 19 X 1, how many units of Product B should be sold to earn the same profit as in 19 X 1.
 (b) If the selling price of Product A is reduced by 5% as compared to 19 X 1, and the quantity sold is increased to 24,000 units, how many units of Product B should be sold to earn the same profit as in 19 X 1.
 (c) If Product A is discontinued, how many units of Product B should be sold to earn the same profit as in 19 X 1.
 (d) If Product A is discontinued and the quantity of Product B is to be restricted to 37,375 units, what percentage increase in selling price of Product B is necessary to earn the same price as in 19 X 1.

Solution :

Suppose Sales Mix = Rs. 1,00,000

	Product A	Product B	Product C
Sales (units)	350	300	
Selling Price (Rs.)	200	100	
Sales (Rs.)	70,000	30,000	1,00,000
Variable Cost	42,000	12,000	54,000
Contribution	28,000	18,000	46,000
P/V Ratio	40%	60%	46%

∴ Combined P/V Ratio = 46%

BEP × P/V ratio = Fixed Cost

∴ BEP = Rs. 23,00,000 ÷ 0.46 = Rs. 50,00,000

Margin of Safety = 20%

∴ Break Even Point = Sales – Margin of Safety
 = 100 – 20 = 80%

Total Sales = 50,00,000 ÷ 0.80 = Rs. 62,50,000

No. of units of A = (Rs. 62,50,000 × 0.70) ÷ Rs. 200 = 21,875 units

No. of units of B = (Rs. 62,50,000 × 0.30) ÷ Rs. 100 = 18,750 units

Statement showing profit in 19 X 1

A – 21,875 × (Rs. 200 – Rs. 120) = Rs. 17,50,000

B – 18,750 × (Rs. 100 – Rs. 40) = 11,25,000

Total 28,75,000

Fixed Cost 23,00,000

5,75,000

Projected cost data for the year 19 X 2

	<i>Product A</i> Rs. 200	<i>Product B</i> Rs. 100
Selling Price		
Variable Cost :		
A – 5% increase	126	
B – 2½% increase		41
Contribution	<u>74</u>	<u>59</u>
P/V ratio	37%	59%

Fixed cost = Rs. 23,00,000 + 5% increase = Rs. 24,15,000

- (a) *Proposal*– Sell the same units of product A as in 19 X 1. How many unit of product is 'B' should be sold to earn the same profit as in 19 X 1

Contribution desired = Rs. 24,15,000 + Rs. 5,75,000 = Rs. 29,90,000

Contribution made by selling 21,875 units of A = Rs. 21,875 × Rs. 74 = Rs. 16,18,750

Balance contribution to be earned by selling product B = Rs. 29,90,000 – Rs. 16,18,750
= Rs. 13,71,250

No of units of product B to earn contribution of

Rs. 13,71,250 = Rs. 13,71,250 ÷ 59 = 23,242 units

- (b) *Proposal* – Selling price of A to be reduced by 5% and 24,000 units of A to be produced. Then, how many units of B to be sold to maintain the same profit.

New selling of A = 200 × 0.95 Rs. 190

Variable Cost 126

64

Contribution desired = Rs. 29,90,000

Contribution by A (24,000 × Rs. 64)

15,36,000

14,54,000

No. of units of B to earn

contribution of Rs. 14,54,000 = Rs. 14,54,000 ÷ 59 = 24,644 units

- (c) *Proposal* – Product A to be discontinued and profit of 19 X 1 to be earned by selling product B.

Contribution desired = Rs. 29,90,000

No. of units of B to be sold

to earn this contribution = Rs. 29,90,000 ÷ 59 = 50,678 units

- (d) *Proposal* – Product A to be discontinued; 37,375 units of B to be produced; percentage increase desired in selling price of product B

Contribution desired = Rs. 29,90,000

Contribution to be earned by selling of product B existing price 37,375 × 59

= 22,05,125

Addition contribution to be earned by increasing price of 37375 units of B

= 7,84,875

Additional price per unit = $7,84,875 + 37,375 = \text{Rs. } 21$

Percentage increase in price of product B = $(21 + 100) \times 100 = 21\%$

Peculiarity of the Problem— Readers should note that combined P/V ratio is to be found out, when sales value ratio of mix is given. Best course is to start by supposing the mix to be a particular number (say Rs. 1,00,000 in this problem).

Problem 181 (Manufacturing vs. Sub-contracting). Motor Components Ltd. have secured an order for 3,000 components per week from a car manufacturer but there is a shortage of available skilled labour capacity which is restraining the Company from producing the entire quantity within the Company.

Production, Cost and Sales information of Motor Components Ltd. are as under :

Sales Price of complete component	—Rs. 1,500
Skilled Labour capacity per week	—7,500 hours
Production Labour rate per hour	—Rs. 120
Variable Production overhead	—50% of Labour Cost
Fixed Overhead cost	—Rs. 5,00,000 per week
Testing Cost for complete component	—Rs. 20

Each component is finally assembled from three sections, made up of one or more parts as under :

	Section		
	I	II	III
Parts per section	5	4	1
Material cost per part	Rs. 60	Rs. 40	Rs. 20
Production labour minutes per part	18 mins.	15 mins.	30 mins.
The subcontract price per component of Rs. 1,400 made up as under	Rs. 700	Rs. 500	Rs. 200

The two production strategies available are :

- to produce as many completed components as possible within the existing weekly skilled labour capacity and subcontract the remaining complete components, and
- produce as many of the three sections of the components as possible and subcontract the remaining sections.

You are to advise which of the above two production strategies would be more profitable for the Company.

Solution :

Key Factor is labour hours i.e., 7,500 hrs.

Time taken :

Section I = 5 Parts \times 18 minutes = 1.5 hrs.

Section II = 4 Parts \times 15 Minutes = 1.0 hr.

Section III = 1 Part \times 30 Minutes = 0.5 hr.

Total time taken by the Component = 3.0 hrs.

No. of components to be produced in 7,500 hrs. = $7,500 \div 3 = 2,500$ Nos.

Statement showing contribution per hour in different sections by manufacturing and not sub contracting.

	Sections		
	I	II	III
Material cost	Rs. 300	Rs. 160	Rs. 20
Labour Cost @ Rs 120 per hour	180	120	60
Variable Production overhead 50% of labour cost	90	60	30
	<hr/> 570	<hr/> 340	<hr/> 110
Subcontract	700	500	200
	<hr/> 130	<hr/> 160	<hr/> 90
Contribution before testing	130	160	90
Labour hours per Section	1.5	1	1/2
Contribution per hour by manufacturing and not subcontracting	86.67	160	180
Ranking	III	II	I

(a) *Strategy 1*—To produce as many completed components as possible and subcontract remaining complete components.

Complete components to be produced in 7,500 hrs. = (7,500 hrs. ÷ 3)	2,500 units
∴ Complete components to be sub contracted (3,000 – 2,500)	500 units
	<hr/> 3,000 units

Profit by strategy 1 :

Variable Cost of Producing 2500 components

Material Cost { (300 + 160 + 20) × 2500 }	=	12,00,000
Labour Cost { (180 + 120 + 60) × 2500 }	=	9,00,000
Variable Cost { (90 + 60 + 30) × 2500 }	=	4,50,000
Testing (2500 × Rs. 20)	=	50,000
Total variable cost		<hr/> 26,00,000
Fixed Cost		5,00,000
Total Cost of Producing 2500 units		<hr/> 31,00,000
Add: (i) Cost of sub contracting 500 units 500 × (700 + 500 + 200)	7,00,000	
(ii) Testing of sub contracting units (500 × 20)	10,000	
Total cost of sub contracting	<hr/>	<hr/> 7,10,000
Total cost of manufacturing 2500 units and sub contracting 500 units (A)		<hr/> 38,10,000

Sale Price (3,000 × Rs. 1,500) (B)	45,00,000
Profit (B – A)	6,90,000

Profit for (b) Strategy 2 – To produce as many of the three sections of the components as possible and sub contract the remaining sections.

Parts required for 3,000 components :

Section 1 — 3000 × 5 = 15,000 Nos.	These parts should be produced for maximising contribution of 7,500 hrs.
Section 2 — 3000 × 4 = 12,000 Nos.	
Section 3 — 3000 × 1 = 3,000 Nos.	

<i>Hrs. utilized</i>	<i>Balance hrs.</i>
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Proposed Plan

Section III— Maximum hrs should be utilized as it is 1st in rank (3000 × 1/2 hr.)	1,500	6,000
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Section II— Maximum hrs should be utilized as it is 2nd in rank (12,000 × 15) ÷ 60	3,000	3,000
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Section I (a) Only 3,000 hrs are left and these should be utilized in manufacturing the parts and for balance parts sub-contracting should be done (3,000 + 1.5 hrs.) = 2000 Parts 2,000 × 1.5 hrs. 3,000

(b) Balance 1,000 Parts (i.e. 3000 – 2000) should be sub-contracted.

Profit under proposed plan based on second strategy

(i) Margin of company if all the complete-1 components were to be sub-contracted 3000 units × (Rs 1,500 – Rs 1,400) Rs. 3,00,000

(ii) Add: Contribution made by not sub contracting and utilizing 7500 hrs. as per proposed plan discussed above.

Sections	Hrs utilized	Contribution per hrs.	
Section I	1,500 hrs.	× Rs. 180	= Rs. 2,70,000
Section II	3,000 hrs.	× Rs. 160	= 4,80,000
Section III	3,000 hrs.	× Rs. 86.67	2,60,000*
			<u>10,10,000</u>
			13,10,000

Less: Fixed Cost	Rs 5,00,000	
Testing Fee (3000 × Rs. 20)	60,000	5,60,000
Profit per week by second strategy		<u>7,50,000</u>

*Rounded off to the nearest 100

Conclusion—Second strategy will increase profit by Rs. 60,000 per week i.e., Rs. 7,50,000 – Rs. 6,90,000

Note : Main point of the question — In second strategy production is to be made to put 7,500 hrs. to maximum use based on ranking of contribution per hour.

Problem 182 (Non-conventional Variance Analysis). Fair View Corporation manufactures a single product and the Standard Costing System is followed. Standard cost per unit is worked out as under :

	Rs.	Rs.
Standard Selling Price		104
Less : Standard Cost		
Materials (5 kgs, @ Rs. 4 per kg.)	20	
Labour (4 hours @ Rs. 8 per hour)	32	
Variable Overheads (4 hours @ Rs. 3 per hour)	12	
Fixed Overheads (4 hours @ Rs. 3 per hour)	12	76
Standard Profit		28

Overheads are allocated on the basis of direct labour hours. In the month of April there was no difference between the budgeted and actual Selling Price and there were no opening or closing stock during the period.

The other details for the month of April are as under :

	Budget 2,000 units	Actuals 1,800 units
Production and Sales		
Direct Materials	10,000 kgs. @ Rs. 4 per kg.	10,000 kgs @ Rs. 4 per kg.
Direct Labour	8,000 hours @ Rs. 8 per hour	7,400 hrs. @ Rs. 8 per hour
Variable Overheads	Rs. 24,000	Rs. 22,200
Fixed Overheads	Rs. 24,000	Rs. 24,000

You are required to calculate the variance and reconcile the budgeted and actual profit according to each of the following methods :

- The conventional method
- The relevant cost method assuming that :
 - materials are scarce and are restricted to a supply of 10,000 kgs. for the period
 - labour hours are limited and the available labour hours are only 8,000 hours for the period.
 - there are no scarce inputs.

Solution

(a) *Reconciliation between the budgeted actual and profit based on the conventional method*

Budgeted Profit	2000 units × Rs. 28		Rs. 56,000
For Material Cost Variances :			
M ₁ – Material Cost Incurred	Rs. 40,000		
M ₂ – Standard Cost of material used	Rs. 40,000		
M ₅ – Standard Material Cost of output			
	1,800 units × Rs. 20	36,000	
Material Volume Variance = M ₂ – M ₅	(Rs. 40,000 – 36,000)	4,000(A)	
For Direct Wage Variance :			
L ₁ – Actual Payment for Labour			
	7400 hrs × Rs. 8	Rs. 59,200	
L ₂ – Payment involved, if the workers had been paid at standard rate			
	7,400 hrs. × Rs. 8	59,200	

L ₅ – Standard labour Cost of output achieved		
1800 units × Rs. 32	57,600	
Wage Efficiency Variance = L ₂ – L ₅ = (59200 – 57600) =	1,600(A)	
<i>For Variable O.H. Variance :</i>		
VO ₁ – Actual variable O.H. incurred = Rs. 22,200		
VO ₂ – Actual hours worked at standard		
variable O.H. rate 7400 hrs. × Rs. 3 = 22,200		
VO ₃ – Standard variable overhead for output		
1800 units × Rs. 12	21,600	
Variable O.H. Efficiency Variance = V ₂ – V ₃ =		
(Rs. 22,200 – 21,600) =	600(A)	
<i>For Fixed O.H. Variance :</i>		
FO ₁ – Actual Fixed O.H. incurred = Rs. 24,000		
FO ₂ – Budgeted F.O.H. = Rs. 24,000		
FO ₃ – No calendar or idle time variance = NIL		
FO ₄ – Actual hours worked at		
standard fixed overhead rate		
7,400 hrs. × Rs. 3.00	22,200	
FO ₅ – Standard fixed O.H. for production		
1800 × Rs. 12	21,600	
Fixed Overhead Capacity Variance		
= FO ₃ – FO ₄ = Rs. 2,4,000 – Rs. 22,200 =	1800(A)	
Fixed O.H. Efficiency Variances		
= FO ₄ – FO ₅ = Rs. 22,200 – Rs. 21,600 =	600(A)	
<i>For Sales Margin Variance</i>		
SM ₁ – Actual Sales Margin on actual sales		
1,800 × (Rs. 104 – Rs. 76)	Rs. 50,400	
SM ₂ – Standard Sales Margin on actual sales		
1,800 × (Rs. 104 – Rs. 76)	Rs. 50,400	
SM ₃ – No sales margin Mix Variance		
	NIL	
SM ₄ – Sales Margin as per budget or standard		
2,000 × (Rs. 104 – Rs. 76)	Rs. 56,000	
Sales Margin Volume Variance (SM ₁ – SM ₄)		
= (Rs. 50,400 – Rs. 56,000)	5,600(A)	14,200(A)
Actual Profit		41,800

Statement showing comparative reconciliation of budgeted profit and actual profit.

Items	Conventional Method	Reconciliation based on different hypothesis of relevant cost		
		Scarce Material	Scarce Labour hours	No scarce of input or sales limiting factor
Budgeted Profit	Rs. 56,000	Rs. 56,000	Rs. 56,000	56,000
Direct Material Usage Variance	4,000 (A)	12,000 (A)	4,000 (A)	4,000 (A)
Direct Labour Efficiency Variance	1,600 (A)	1,600 (A)	3,600 (A)	1,600 (A)
Variable O.H. Efficiency Variance	600 (A)	600 (A)	600 (A)	600 (A)
Fixed O.H. Capacity Variance	1,800 (A)	—	—	—
Fixed O.H. Efficiency Variance	600 (A)	—	6,000 (A)	—
Sales Margin Volume Variance	5,600 (A)	—	—	8,000 (A)
Actual Profit	41,800	41,800	41,800	41,800

Note : (i) Reconciliation on conventional method is as per (a)

(i) *Scarce Material* : Based on conventional method, direct material usage variance is Rs. 4,000 (A), i.e., 1000 kg. \times Rs. 4. In this situation material is scarce, and therefore, material cost variance based on relevant cost method should also include contribution lost per unit of material

Selling Price Rs. 104

Less Variable Cost

Material (5 kg. \times Rs. 4) = Rs. 20

Labour (4 hrs. \times Rs. 8) = Rs. 32

Variable O.H. (4 hrs. \times Rs. 3) = 12 64

Contribution per unit 40

Material used per unit 5 kg.

Contribution per kg. (Rs. 40 \div 5) = Rs. 8

\therefore Excess usage of 1000 kg leads to lost contribution of Rs. 8,000 i.e., Rs. 1,000 \times Rs. 8.

\therefore Total Material usage variance based on relevant cost method, when material is scarce will be Rs. 8000 (A) + Rs. 4000 (A) = Rs. 12,000 (A)

Since labour is not scarce, labour variances are identical to conventional method.

(iii) *Scarce Labour* : Material is no longer scarce, and therefore the direct material usage variance will be Rs. 4000 (A) i.e., as per conventional method. In conventional method excess labour hours used are : 7,400 hrs – (1800 units × 4 hrs.) = 200 hrs. Contribution lost per hour = Rs. 40 ÷ 4 = Rs. 10. Therefore contribution lost per unit, when labour is scarce will be : 200 hrs × Rs. 10 = Rs. 2,000

Therefore, total labour efficiency variance, when labour hours are scarce will be Rs. 3,600 i.e. Rs. 1,600 (as per conventional method) + Rs. 2,000. Variable efficiency variance will not change due to scarce labour hours. Fixed overhead is a sunk cost. Relevant capacity variance will be Rs. 6000 (A) i.e., 600 hours × Rs. 10. Sales margin variance etc. are irrelevant in case of scarce labour hours, as it is not the function of sales manager to use labour hours efficiently.

Sales limiting factors : As material and labour are not the limiting factors, the same conventional variances hold good i.e., material usage variance, labour efficiency variance, variable overhead variance will remain the same. The lost sales volume is 200 units. Therefore contribution lost will be Rs. 8,000 i.e. 200 units × Rs. 40. This is different from sales margin variance of Rs. 5,600 as shown in conventional method.

Problem 183. (Perfect Prediction —Use of Probability). D. Ltd. has to choose one between two machine—Machine A has low fixed costs and high unit variable costs whereas Machine B has high fixed costs and low unit variable costs. Consequently Machine A is suited to low level demand while Machine B is suited to high level demand. It is assumed that there are only two possible demand levels—low and high—and the estimated probability of each of these events is 0.5. The estimated profits for each demand level are as follows :

	Low demand	High demand
	Rs.	Rs.
Machine A	1,00,000	1,60,000
Machine B	10,000	2,00,000

There is a possibility of employing a firm of marketing consultants who would be able to provide a perfect prediction of the actual demand. What is the maximum amount the company should be prepared to pay the consultants for the additional information?

If D. Ltd does not employ the marketing consultants, it has, by itself, to choose between the two machines. In that case work out the regret criteria.

Solution

Machine A

$$\text{Expected Value} = (0.50 \times \text{Rs. } 1,00,000) + (0.50 \times \text{Rs. } 1,60,000) = \text{Rs. } 1,30,000$$

Machine B

$$\text{Expected Value} = (0.50 \times \text{Rs. } 10,000) + (0.50 \times \text{Rs. } 2,00,000) = \text{Rs. } 1,05,000$$

Based on expected value decision rule, only Machine A should be purchased (The conclusion does not consider any other information). If demand is low, then Machine A should be purchased. If demand is high then Machine B is to be

purchased. The revised expected value will be $(0.5 \times 1,00,000) + (0.5 \times 2,00,000) = \text{Rs. } 1,50,000$. When the decision to employ the consultant is taken, the best outcome from obtaining additional information is a 0.5 probability that it will be low demand or 0.5 probability that it will be a high demand.

(i) The value of additional information is to be arrived at by deducting the expected value without the market survey i.e., Rs. 1,30,000 from expected value with market survey i.e., Rs. 1,50,000. Thus the expected value of perfect information is Rs. 20,000. As long as the cost obtaining the information is less than Rs. 20,000, the firm of market consultant should be employed.

(ii) No consultant and choice is to be made based on regret criteria

Regret criteria

State of nature

	High Demand	Low Demand
Choose Machine 'A'	2,00,000 – 1,60,000 = Rs. 40,000	Rs. 0
Choose Machine 'B'	Rs. 0	(Rs. 1,00,000 – Rs. 10,000) = Rs. 90,000

Problem 184 (Make or Buy—Use of EOQ). A company is considering the possibility of purchasing from a supplier a component it now makes. The supplier will provide the components in the necessary quantities at a unit price of Rs. 9. Transportation and storage costs would be negligible.

The company produces the component from a single raw material in economic lots of 2,000 units at a cost of Rs. 2 per unit. Average annual demand is 20,000 units. The annual holding cost is Rs. 0.25 per unit and the minimum stock level is set at 400 units. Direct labour costs for the component are Rs. 6 per unit, fixed manufacturing overhead is charged at a rate of Rs. 3 per unit based on a normal activity of 20,000 units. The company also hires the machine on which the components are produced at a rate of Rs. 200 per month.

Should the company make the component?

Solution :

This cost of placing an order, when component is purchased, is not given. This can be found out by EOQ formula.

$$\text{EOQ} = \frac{\sqrt{2 \times \text{Annual consumption} \times \text{Cost of placing an order}}}{\text{Cost of carrying one unit of inventory for one year}}$$

Substituting the available information

$$2000 = \frac{\sqrt{2 \times 20,000 \times x}}{0.25} = x = \text{Rs. } 25$$

\therefore Cost of placing an order = Rs. 25

Average stock level = Minimum stock level + $\frac{1}{2}$ EOQ

$$= 400 + \frac{1}{2}(2000) \text{ or } 1400 \text{ units}$$

Comparison of annual Costs

<i>Make</i>		<i>Buy</i>	
(i) Storage cost		Purchase Cost :	
1400×0.25	=Rs. 350	$20,000 \times 9$	= 1,80,000
(ii) Ordering cost			
$(20,000 \div 2,000) \times 25$	=	250	
(iii) Material cost			
$20,000 \times 2$	= 40,000		
(iv) Labour cost			
$20,000 \times 6$	=1,20,000		
(v) Rental charges			
$\text{Rs } 200 \times 12$	= 2,400		
	1,63,000		1,80,000

Conclusion : The company should make the component, till it has some alternative use for existing capacity. If it is possible to find an alternative use for existing capacity so that opportunity cost exceeds Rs. 17,000 i.e., Rs. 1,80,000 -- Rs. 1,63,000, buying will become better than manufacturing. Labour cost has been presumed to be variable cost. Fixed cost being sunk cost is not relevant for decision making.

Problem 185. (Use of Probability—Relevant Cost Analysis). W. Ltd. is to produce a new product in a Short-term Venture which will utilize some obsolete materials and expected spare capacity. The new product will be advertised in Quarter I with production and sales taking place in Quarter II. No further production or sales are anticipated.

Sales volumes are uncertain but will, to some extent, be function of sales price. The possible sales volumes and the advertising costs associated with each potential sales price are as follows :

Sales price Rs. 20 per unit		Sales price Rs. 25 per unit		Sales price Rs. 40 per unit	
Sales Volume (units) (000's)	Probability	Sales Volume (units) (000's)	Probability	Sales Volume (units) (000's)	Probability
4	0.1	2	0.1	0	0.2
6	0.4	5	0.2	3	0.5
8	0.5	6	0.2	10	0.2
—	—	8	0.5	15	0.1
Advertising cost	Rs. 20,000	Rs. 50,000		Rs. 1,00,000	

The resources used in the production of each unit of the product are :

Production Labour : Grade I—2 Hours
: Grade II—1 Hour

Materials x —1 unit
y —? unit

The normal cost per hour of labour is :

Grade I—Rs. 2

Grade II—Rs. 3

However, before considering the effects of the current venture, there is expected to be 4,000 hours of idle time for each grade of labour in Quarter II. Idle time is paid at the normal rates.

Material *x* is in stock at a book value of Rs. 8 per unit but is widely used within the firms and any usage for the purposes of this venture will require replacing. Replacement cost is Rs. 9 per unit.

Material *y* is obsolete stock. There are 16,000 units in stock at a book value of Rs. 3.50 per unit and any stock not used will have to be disposed of at a cost, to W. Ltd. at Rs. 2 per unit. Further quantities of *y* can be purchased for Rs. 4 per unit.

Overhead recovery rates are :

Variable Overhead Rs. 2 per direct labour hour worked. Fixed Overhead Rs. 3 per direct labour hour worked. Total fixed Overheads will not alter as a result of the current venture.

Feedback from advertising will enable the exact demand to be determined at the end of Quarter I and production in Quarter II and production in Quarter II will be set to equal that demand. However it is necessary to decide *now* on the sales price in order that it can be incorporated into the advertising campaign.

Required :

- (a) Calculate the expected money value of the venture at each sales price and on the basis of this, advise W. Ltd. of its best course of action.
- (b) briefly explain why the management of W. Ltd. might rationally reject the sales price leading to the highest expected money value and prefer one of the other sales prices.

Solution :

Based on sales volumes indicated, production cost for each sales volume should be first determined. This can be done in two stages. First relevant cost for a particular range should be determined because relevant cost will be different at different ranges as per the information given. Then production cost for required output should be determined.

(i) *Statement showing relevant Cost per unit for different ranges :*

Details	For Units 1—2000	For Units 2001—4000	For Units 4001 to 8000	For Units Over 8000
Costs				
Labour :				
Grade I (Note 1)	—	4	4	4
Grade II (Note 1)	—	—	3	3
Material :				
<i>x</i> (Note 2)	9	9	9	9
<i>y</i> (Note 3)	(4)	(4)	(4)	8
Variable overhead (Note 4)	6	6	6	6
Total relevant cost per unit	11	15	18	30

(ii) Statement showing relevant cost for required levels of output mentioned in the question.

Output ('000 units)	Total Cost (Rs. '000)
2	22
3	37 (Rs. 22 + 1 unit × Rs. 15)
4	52 (Rs. 37 + 1 unit × Rs. 15)
5	70 (Rs. 52 + 1 unit × Rs. 18)
6	88 (Rs. 70 + 1 unit × Rs. 18)
8	124 (Rs. 88 + 2 unit × Rs. 18)
10	184 (Rs. 124 + 2 unit × Rs. 30)
15	334 (Rs. 184 + 5 unit × Rs. 30)

(a) Statement showing the outcomes and expected values for each selling price

Volume Sales Revenue		Outcomes and Expected Value				
units ('000)	(Rs. '000)	Production Costs (Rs. '000)	Adver- tising Costs (Rs. '000)	Profit (Rs. '000)	Pro- bability	Expected value Rs. 000
Selling Price Rs. 20						
4	80	52	20	8	0.1	0.8
6	120	88	20	12	0.4	4.8
8	160	124	20	16	0.5	8.0
						<u>13.6</u>
Selling Price Rs. 25						
2	50	22	50	(22)	0.1	(2.2)
5	125	70	50	5	0.2	1.0
6	150	88	50	12	0.2	2.4
8	200	124	50	26	0.5	13.0
						<u>14.2</u>
Selling Price Rs. 40						
0	0	0	100	(100)	0.2	(20.0)
3	120	37	100	(17)	0.5	(8.5)
10	400	184	100	116	0.2	23.2
15	600	334	100	166	0.1	16.6
						<u>11.3</u>

Selling price of Rs. 25 should be selected.

(b) For decision making in this situation, maximising expected value is not the only equitable criterion. Company may follow minimisation of risk as the criteria for selection and in that case Rs. 20 is the only price, it which loss will not arise. Final decision will depend on each of the above probability distribution and managements attitude towards risk.

Note : 1. Labour Costs are relevant when idle time gets exhausted. This occurs at 2000 units for grade I labour (2000 units × 2 hours) and 4000

units for grade II labour (4000 units \times 1 hour). Beyond these output levels, normal cost per hour *i.e.*, Rs. 2 for grade I and Rs. 3 for grade II will be incurred.

2. Replacement cost of Rs. 9 is the relevant cost in this situation because this material is widely used and any usage will require replacement at Rs. 9 per unit.
3. Each unit of Y used saves Rs. 2 or Rs. 4 per unit *i.e.*, 2 units Rs. 2
4. Variable overhead for each unit will be Rs. 6 *i.e.* 3 hrs \times Rs. 2.

Problem 186 (Best production programme—Shadow Price). A manufacturer has three products A, B and C. Current sales, cost and selling price details and processing time requirements are as follows :

	Product A	Product B	Product C
Annual Sales (units)	6000	6000	750
Selling Price (Rs.)	20	31	39
Unit Cost (Rs.)	18	24	30
Processing time required per unit (hours)	1	1	2

The firm is working at full capacity (13,500 processing hours per year). Fixed manufacturing overheads are absorbed into unit costs by a charge of 200% of variable costs. This procedure fully absorbs the fixed manufacturing overheads. Assuming that :

- (i) processing time can be switched from one product line to another
- (ii) the demand at current selling price is :

Product A	Product B	Product C
11,000	8,000	2,000

(iii) the selling prices are not to be altered, you are required to calculate the best production programme for the next operating period and to indicate the increase in net profit that this should yield. In addition identify the *shadow price* of processing hour.

Solution :

It is given in the question that fixed manufacturing overheads are absorbed into unit costs by a charge of 200% of variable costs. Now variable cost relating to all the three products can be found out by presuming variable cost to be x :

- Product A ; $x + 2x = 18$ or $x = 6$
 Product B ; $x + 2x = 24$ or $x = 8$
 Product C ; $x + 2x = 30$ or $x = 10$

Statement showing contribution per hour

	Product A Rs. 20	Product B Rs. 31	Product C Rs. 39
Selling Price			
Variable Cost	6	8	10
Contribution per unit	14	23	29

Processing time required per unit (Given)	1 hr.	1 hr.	2 hr.
Contribution per processing hour	Rs. 14	23	14.50
Ranking	III	I	II

		Existing contribution		
		Production (in hrs.)	Contribution per hour	Total Contribution
Product A	6,000 units	6000 hrs.	Rs. 14	Rs. 84,000
Product B	6,000 units	6,000 hrs.	23	1,38,000
Product C	750 units	1,500 hrs.	14.50	21,750
				<u>2,43,750</u>

Company is working at full capacity of 13,500 processing hours per year.

Proposed Optimal Programme

Product	Rank	Hrs. to be used	Balance hours
Product B	I	8,000 hrs. (Maximum)	5,500
Product C	II	4,000 hrs. (Maximum)	1,500
Product A	III	1,500 hrs.	—

Contribution based on optimum programme

Product	Hrs used	Contribution per hr	Total Contribution
Product B	8,000	Rs. 23	Rs. 1,84,000
Product C	4,000	14.50	Rs. 58,000
Product I	1,500	14	21,000
			<u>2,63,000</u>

The optimal programme will increase profit by Rs. 19,250 i.e., Rs. 2,63,000 – Rs. 2,43,750. The shadow price is the opportunity cost of one unit of resource for the decision maker. In this situation, every extra processing hour will increase contribution by Rs. 14.00. Therefore, the shadow price (or opportunity cost) of the scarce processing hours is Rs. 14.00.

Note - (i) Determinations of variable cost and shadow price should be particularly noted in this problem.

(ii) For conceptual discussion on shadow price, please refer to Advanced Cost and Management Accounting-Text by Saxena and Vashist.

Problem 187 (CPP Method). The Balance Sheet of Upto Date Ltd as on 31st December 1988 and the Profit and Loss Account during the year 1989 are as under.

Balance sheet as at 31-12-1988

Liabilities		Assets	
	Rs.		Rs.
Share Capital	40,000	Plant & Machinery	60,000
13.5% Debentures	24,000	Stocks	9,600
Sundry Creditors	14,400	Debtors	4,800
		Cash	4,000
	<u>78,400</u>		<u>78,400</u>

Profit & Loss A/c for the year ended 31-12-1989

	Rs.		
To opening stock	9,600	By Sales	40,000
Purchases	18,400	Closing Stock	8,000
Gross Profit	20,000		
	<u>48,000</u>		<u>48,000</u>
To Expenses	3,200	By Gross Profit	20,000
Interest on Debentures	3,240		
Depreciation	6,000		
Net Profit	7,560		
	<u>20,000</u>		<u>20,000</u>

The following information is relevant :

- (i) There is no change in Debtors and Creditors during the year
- (ii) Following indices are to be taken :

On 1st January 1989	200
Average of 1989	240
On 31st December 1989	300
- (iii) First-In-First Out method is used

You are required to prepare the final accounts for the year 1989 after adjusting for price level changes under CPP method.

Solution

Income Statement restated as per CPP Method for the year ended 31st December 1989.

	Historical	Conversion Factor	CPP
	Rs. 40,000		Rs. 50,000
Sales		$300 + 240 = 1.25$	
Opening Stock	9,600	$300 + 200 = 1.5$	14,400
Purchases	18,400	$300 + 240 = 1.25$	23,000
Cost of goods available for sale	28,000		37,400
Less : Closing Stocks (FIFO)	8,000	$300 + 240 = 1.24$	10,000
Cost of Goods sold	20,000		27,400
Gross Profit on Sale	20,000		22,600
Operating Expenses	3,200	$300 + 240 = 1.25$	4,000
Depreciation	6,000	$300 + 200 = 1.5$	9,000
Interest on Debentures	3,240		3,240
Profit before adjustment	7,560		6,360
Price Level Gain	—		10,200
Retained Earnings	7,560		16,560

Notes : Debentures and CreditorsAs on 1-1-1989....Rs. $38,400 \times 1.5 =$ 57,600

But they remained 38,400

19,200Cash and Debtors $8,800 \times 1.5 =$ 13,200Purchases $18,400 \times 1.25 =$ 23,00036,200But stayed at $(8,800 + 18,400) = 27,200$ 9,000Total gain on monetary asset 10,200*Balance sheet of Upto Date Ltd. as on 31-12-1989*

	Historical	Conversion	CPP
	Rs.		Rs.
Share Capital	40,000	1.5	60,000
Debentures	24,000	1.0	24,000
Sundry creditors	14,400	1.0	14,400
Retained Earnings	7,560		16,560
Total	<u>85,960</u>		<u>1,14,960</u>
Cash	19,160*	1.0	19,160
Debtors	4,800	1.0	4,800
Stock	8,000	1.25	10,000
Plant and Machinery	60,000	1.5	90,000
Less : Depreciation	(6,000)	1.6	(9,000)
	<u>85,960</u>		<u>1,14,960</u>

** Determination of closing balance*

Closing Balance	Rs. 4,000	
Sales	<u>40,000</u>	
	44,000	
Less : Purchases	Rs. 18,400	
Operating expenses	3,200	
Interest on Debentures	<u>3,240</u>	24,840
		<u>19,160</u>

Cash before payment of interest

 $= \text{Rs. } 19,160 + 3,240 = \text{Rs. } 22,400$

C.A. Inter November 1990

Problem 188 (Contract Costing—Memorandum Account).
Rex Limited commenced a contract on 1-7-1988. The total contract price was Rs 5,00,000 but Rex Limited accepted the same of Rs. 4,50,000. It was decided to estimate the total profit and to take to the credit of profit and loss account that proportion of estimated profit on cash basis which the work completed bore to the total contract. Actual expenditure till 31-12-1988 and estimated expenditure in 1989 are given below :

<i>Expenses</i>	<i>Actuals (Till 31-12-88)</i>	<i>Estimate (For 1989)</i>
Materials	Rs. 75,000	Rs. 1,30,000
Labour	55,000	60,000
Plant Purchased (original cost)	40,000	—
Misc. Expenses	20,000	35,500
Plant Returned to Stores on 31-12-88 at original cost	10,000	25,000 as at 30-9-89
Materials at Site	5,000	-Nil-
Work Certified	2,00,000	Full
Work Uncertified	7,500	-Nil-
Cash Received	1,80,000	Full

The plant is subject to annual depreciation @ 20% of original cost. The contract is likely to be completed on 30-9-1989.

You are required to prepare the contract account for the year ended 31-12-88. Workings should be clearly given. It is the policy of the company to charge depreciation on time basis.

Solution.

Contract Account for the year ending 31-12-1988

To Materials	Rs. 75,000	By Plant returned to stores* (original cost less depreciation)	Rs. 9,000
" Labour	55,000	" Plant at site after depreciation*	27,000
" Plant (at original cost)	40,000	" Material at site	5,000
" Miscellaneous Expenses	20,000	" W.I.P. :	
" Balance c/d	58,500	Work certified	2,00,000
	<u>2,48,500</u>	Work uncertified	7,500
			<u>2,48,500</u>
" Profit and Loss A/c@	26,400	By Balance c/d	58,500
" Reserve transferred to WIP	32,100		<u>58,500</u>
	<u>58,500</u>		
<i>1st January 1989</i>			
To W.I.P.			
Work certified	2,00,000		
Work uncertified	7,500		
" Plant at site	27,000		
" Material at site	5,000		
	<u>2,39,500</u>		
Less Reserve	32,100		
	<u>2,07,400</u>		

Working Notes

*(Memorandum Contract Account
 (1st July 1988 to 30th September 1989))*

To Materials (Rs. 75,000 + 1,30,000)	2,05,000	By Plant returned to Stores	27,750
Labour (Rs. 55,000 + 60,000)	1,15,000	(Notes (i) and (ii))	
Plant	40,000	" Plant at site – Note (iv)	3,750
Miscellaneous expenses (Rs. 20,000 + Rs. 35,500)	55,500	" Contractor's A/c	4,50,000
Estimated Profit	66,000		
	<u>4,81,500</u>		<u>4,81,500</u>

(i) Calculation of the value of plant returned to stores as on 31-12-1988

Original cost	Rs. 10,000	
Less : Depreciation @ 20% for 6 months	1,000	Rs. 9,000

(ii) Plant at site as on 31-12-88

Original Cost	Rs. 40,000	
Less : Plant returned to stores	Rs. 10,000	
Depreciation on plant (1/2 × 30,000 × 20%)	3,000	Rs. 27,000

(iii) Plant returned to stores as on 30-9-1989

Original Cost	Rs. 25,000	
Less Depreciation @ 20% for 15 months	6,250	Rs. 18,750

(iv) Plant at site as on 30-9-1989

Original Cost	Rs. 5,000	
Less : Depreciation @ 20% for 15 months	1,250	Rs. 3,750

@ Profit transferred to P & L A/c ending 31-12-88

$$= \text{Estimated Profit} \times \frac{\text{Cash Received}}{\text{Work certified}} \times \frac{\text{Work certified}}{\text{Total Contract Price}}$$

$$= \text{Rs } 66,000 \times \frac{1,80,000}{2,00,000} \times \frac{2,00,000}{4,50,000} = \text{Rs. } 26,400$$

Note : (a) In certain cases, where work is almost complete standard formula for finding out the amount to be credited to P & L A/c is not used. In this problem the following language is specific and standard formula has to be modified suitably :

"It was decided to estimate the total profit and to take to the credit of P & L A/c that portion of estimated profit on cash basis which the work completed bore to the original contract."

(b) Work certified is considered to be equal to work completed.

For Question on most economical purchase level with discount, please refer to Problem 1-26 on page P1-37.

Problem 189. (Integral Accounts—Journal Entries). Dutta Enterprises operates an integral system of accounting. You are required to pass the Journal Entries for the following transactions that took place for the year ended 30-6-1990.

(Narrations are not required)

Raw Materials Purchased (50% on Credit)	Rs. 6,00,000
Materials Issued to Production	4,00,000
Wages Paid (50% Direct)	2,00,000
Wages Charged to Production	1,00,000
Factory Overheads Incurred	80,000
Factory Overheads Charged to Production	1,00,000
Selling and Distribution Overheads Incurred	40,000
Finished Goods at Cost	5,00,000
Sales (50% Credit)	7,50,000
Closing Stock	Nil
Receipts from Debtors	2,00,000
Payments to Creditors	2,00,000

Solution.

Journal Entries—Integral System of Accounting

Stores Ledger Control A/c	Dr.	Rs. 6,00,000	
To Sundry Creditors A/c			Rs. 3,00,000
" Cash or Bank A/c			3,00,000
Work-in-Progress Control A/c	Dr.	4,00,000	
To Stores Ledger Control A/c			4,00,000
Wages Control A/c	Dr.	2,00,000	
To Cash			2,00,000
Work-in-Progress Control A/c	Dr.	1,00,000	
Factory Overhead Control A/c	Dr.	1,00,000	
To Wages Control A/c			2,00,000
Factory Overhead Control A/c	Dr.	80,000	
To Cash or Bank A/c			80,000
Work-in-Progress Control A/c	Dr.	1,00,000	
To Factory Overhead Control A/c			1,00,000
Selling and Distribution Overhead Control A/c	Dr.	40,000	
To Cash or Bank A/c			40,000
Finished Goods Ledger Control A/c	Dr.	5,00,000	
To Work-in-progress Control A/c			5,00,000
Cost of Sales A/c	Dr.	5,40,000	
To Finished Goods Ledger Control A/c			5,00,000
" S&D Overhead Control A/c			40,000
S. Debtors A/c	Dr.	3,75,000	
Cash or Bank A/c	Dr.	3,75,000	
To Sales A/c			7,50,000
Cash or Bank A/c	Dr.	2,00,000	
To S. Debtors A/c			2,00,000
S. Creditors A/c	Dr.	2,00,000	
To Cash or Bank A/c			2,00,000

Problem 190 (Break-even Chart). Following is the data taken from the records of a concern manufacturing a special part ZED.

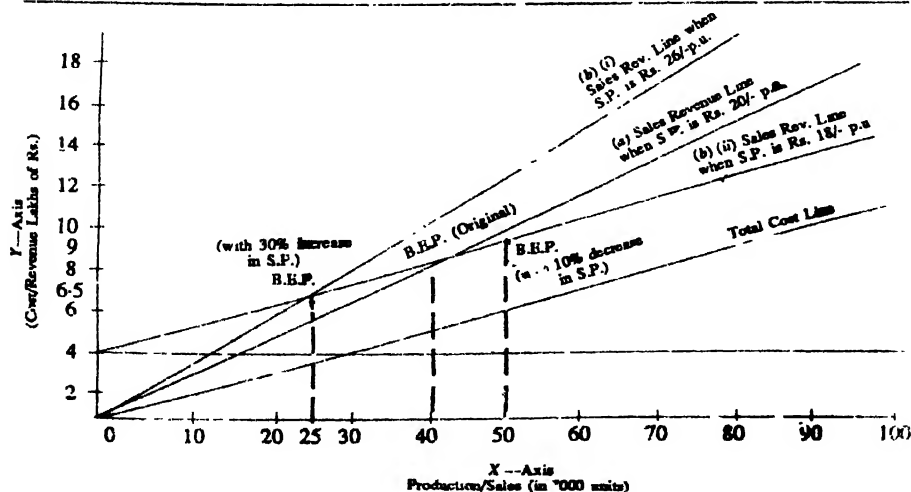
Selling price per unit	Rs. 20
Direct material cost per unit	Rs. 5
Direct labour cost per unit	Rs. 3
Variable overhead cost per unit	Rs. 2
Budgeted level of output and sales	80,000 units
Budgeted recovery rate of fixed overheads cost per unit	Rs. 5

You are required to :—

- Draw a break-even chart showing the break-even point.
- In the same chart show the impact of break-even point :
 - If selling price per unit is increased by 30% and
 - If selling price per unit is decreased by 10%.

Solution. (a) For drawing the break-even chart it is necessary to arrive at the values of total sales, total costs fixed costs, and quality of production/sales etc. and the same is tabulated as under :

Budgeted Units ('000 Nos.)	Total variable cost @ Rs 10 per unit	Total fixed cost	Total cost	Total Sales @ Rs. 20 per unit	Total Sales @ Rs. 26 per unit	Total Sales @ Rs. 18 per unit
	Rs	Rs	Rs.	Rs.	Rs	Rs.
10	1,00,000	4,00,000	5,00,000	2,00,000	2,60,000	1,80,000
20	2,00,000	4,00,000	6,00,000	4,00,000	5,20,000	3,60,000
30	3,00,000	4,00,000	7,00,000	6,00,000	7,80,000	5,40,000
40	4,00,000	4,00,000	8,00,000	8,00,000	10,40,000	7,20,000
50	5,00,000	4,00,000	9,00,000	10,00,000	13,00,000	9,00,000
60	6,00,000	4,00,000	10,00,000	12,00,000	15,60,000	10,80,000
70	7,00,000	4,00,000	11,00,000	14,00,000	18,20,000	12,60,000
80	8,00,000	4,00,000	12,00,000	16,00,000	20,80,000	14,40,000
90	9,00,000	4,00,000	13,00,000	18,00,000	23,40,000	16,20,000
100	10,00,000	4,00,000	14,00,000	20,00,000	26,00,000	18,00,000



- (a) It is noticed from the above B.E. chart that the B.E. Point at original selling price is 40,000 units or sales value of Rs. 8,00,000
- (b) (i) The B.E. Point at increased price (30% increase in S.P.) is 25,000 units or sales value of Rs. 6,50,000
- (b) (ii) The B.E. Point at reduced price (10% reduction in S.P.) is 50,000 units or sales value of Rs. 9,00,000.

Problem 191. (Finding out Actual/Standard Cost with given information/variance). JS Limited used a full standard cost system with raw materials inventory carried at standard. The following data was taken from the records of the company for the year ended 31-12-1989 :

Opening raw materials inventory	300
Closing raw materials inventory	250
Net purchases	410
Material price variance	10 (A)
Materials usage variance	20 (A)
Direct labour cost (Actuals)	900
Direct labour cost at standard	840
Actual overhead cost incurred	875
Overheads cost variance	45 (F)
Opening work in progress inventory	120
Closing work in progress inventory	140
Opening finished goods inventory	360
Cost of goods sold reported	2,240

Note : (F) denotes favourable and ('A') denotes adverse

You are required to compute :

- (1) Raw Material purchases at standard
- (2) Raw Materials consumed at actuals.
- (3) Raw Materials consumed at standard.
- (4) Labour cost variance.
- (5) Standard overhead costs.
- (6) Total manufacturing cost at standard
- (7) Cost of goods manufactured.
- (8) Cost of products sold to customers
- (9) Closing finished goods inventory.

Solution.

- (1) *Raw Material purchases at standard*

Net Purchases	Rs. 410
Less : Adverse Material Price Variance	10
Raw material purchases at standard	400

- (2) *Raw Materials Consumed at actual (or actual consumption at standard price)*

Opening Inventory of raw material	Rs. 300
Add Raw Material purchased at standard price	400
	700

Less : Closing stock of raw material	250	
Actual raw material consumption at standard price	<u>450</u>	
(3) <i>Raw Material Consumed at standard (i.e., raw material consumed at standard price, if consumption had been as per standard)</i>		
Actual raw material consumption at standard price	Rs. 450	
Less : Adverse Material usage variance	<u>20</u>	
Consumption of raw material as per standard at std. price	<u>430</u>	
(4) <i>Labour Cost Variances :</i>		
Direct Labour Cost (Actual)	Rs 900	
Direct Labour Cost at standard	<u>840</u>	
Labour Cost Variance	<u>60</u>	(A)
(5) <i>Standard Overhead Costs :</i>		
Actual Overhead cost incurred	Rs. 975	
Add : Favourable Overhead Cost Variance	<u>45</u>	
Standard Overhead Cost	<u>920</u>	
(6) <i>Total Manufacturing cost at standard :</i>		
Raw Material	Rs. 430	
Labour	840	
Overhead	<u>920</u>	
	<u>2,190</u>	
(7) <i>Cost of goods manufactured (at standard) :</i>		
Opening Work-in-progress + Manufacturing cost at standard—Closing work-in-progress		
Rs 120 + Rs 2,190 – Rs. 140 = Rs. 2,170		
(8) <i>Cost of product sold to customer (at standard) :</i>		
Cost of goods sold reported	Rs. 2,240	
Add : Favourable Overhead Cost Variance	<u>45</u>	
	<u>2,285</u>	
Less : Adverse Variances		
Price Variance	10	
Usage Variance	20	
Labour Cost	<u>60</u>	
	<u>90</u>	
	<u>2,195</u>	
(9) <i>Closing Finished Goods Inventory (at Standard)</i>		
Opening F.G Inventory	Rs. 360	
Add : Cost of Good Manufactured	<u>2,170</u>	
	<u>2,530</u>	
Less : Cost of product sold to customer	<u>2,195</u>	
	<u>335</u>	

C.A. Inter December, 1990

Problem 192. (Contract Account including Balance Sheet). Omega Limited commenced its operations on 1st January, 1989. The company was engaged on only one contract, the price of which was Rs. 10,00,000. The Trial Balance of the company as on 31st December, 1989 was as follows :

Share Capital	Rs.	Rs. 2,00,000
Creditors		20,000
Cash received on Contract (80% of work certified)		4,00,000
Land and Buildings	80,000	
Bank Balance	48,000	
<i>Charged to Contract :</i>		
Materials	1,80,000	
Plant (Original Cost 1.1.89)	50,000	
Wages	2,50,000	
Expenses	12,000	
	6,20,000	6,20,000

The following are the additional information which are to be considered before finalisation of the accounts :

- (1) Wages Outstanding Rs. 30,000
- (2) Expenses Outstanding Rs. 2,000.
- (3) Depreciation on Plant 10% per annum on time basis.
- (4) Materials on hand at site as on 31-12-89 were Rs. 8,000.
- (5) A part of plant (Original cost Rs. 10,000) was destroyed by fire on 30-9-89. This was subsequently sold as scrap for Rs. 2,000 on 31-12-89.
- (6) Materials costing Rs. 8,000 was also destroyed on 30-9-89.
- (7) Plant (Original cost Rs. 10,000) was returned to stores on 31-12-89.
- (8) Work uncertified as on 31-12-89 was Rs. 4,000.

You are required :

- (a) Prepare Contract Account for the period ended 31-12-89.
- (b) Abnormal Loss Account.
- (c) Profit and Loss Account for the year ended 31-12-89 and
- (d) Balance Sheet as on 31-12.89.

Solution.

1(a)

Contract A/c for the year ended 31st December 1989.

	Rs.		Rs.
To Materials	1,80,000	By Material at site	8,000
" Plant (original cost 1.1.89)	50,000	" Plant at site Rs. 30,000*	
" Wages Rs. 2,50,000		Less Depreciation 10%	
Add : Outstanding 30,000	2,80,000		3,000
	"		27,000
" Expenses 12,000		Abnormal Loss A/c :	
Add : Outstanding 2,000	14,000	—Material lost due to fire	8,000
		—Plant scrapped due to fire	8,000
		" Bank A/c (scrap value from plant)	2,000

Balance c/d	42,000	" Plant returned to stock Rs. 10,000 Less Depreciation 1,000	9,000
		" Work-in-progress : Work certified Rs. 5,00,000 Work uncertified 4,000	5,04,000
	5,66,000		5,66,000
To Profit & Loss A/c	22,400	By Balance b/d	42,000
" Work-in-Progress A/c (Reserve)	19,600		
	42,000		42,000

*Original cost (Rs. 50,000) – Lost in fire (Rs. 10,000) – Returned to store (Rs. 10,000) = Rs. 30,000

$$\begin{aligned}\text{Profit taken to P \& L A/c} &= \text{Rs. } 42,000 \times \frac{2}{3} \times \frac{\text{Cash received}}{\text{Work certified}} \\ &= \text{Rs. } 42,000 \times \frac{2}{3} \times \frac{4,00,000}{5,00,000} \\ &= \text{Rs. } 22,400\end{aligned}$$

(b) **Abnormal Loss Account**

To Contract A/c Rs. 8,000 (material destroyed due to fire)	By P& L A/c Rs. 16,000
" Contract A/c 8,000 (Plant destroyed due to fire)	
16,000	16,000

(c) **Profit and Loss Account**

To Abnormal Loss A/c Rs. 16,000	By Contract A/c Rs. 22,400
" Profit carried to B/S 6,400	
22,400	22,400

(d) **Balance Sheet**

as on 31st December, 1989

Liabilities	Amount	Assets	Amount
Share Capital	Rs. 2,00,000	Land and Buildings	Rs. 30,000
Profit and Loss A/c	6,400	Plant : -At Store 27,000	
Creditors	20,000	At site 9,000	36,000
Outstanding expenses :		Material at site	8,000
Wages 30,000		Work-in-progress :	
Other expenses 2,000	32,000	Work certified 5,00,000	
		Work uncertified 4,000	
		5,04,000	
		Less : Reserve 19,600	
		4,84,400	
		Less : Cash received 4,00,000	84,400
		Bank balance 48,000	
		Add : Scrap value of plant 2,000	50,000
	2,58,400		2,58,400

Problem 193. (Machine Hour Rate). A Machine Shop Cost Centre contains six machines of equivalent capacities. Three operators are employed on each machine, one at Rs. 10 an hour and two at Rs. 5 per hour each. The factory works a forty hour week which includes four hours for set up time. The work is jointly done by the operators. The operators are paid fully for the forty hours. In addition they are paid a bonus of 10% on productive time. Costs are reported for this company on the basis of thirteen four weekly periods.

The company for the purposes of computing machine hour rate includes the direct wages of the operators and also recoups the factory overheads allocated to the machines. The following details of factory overheads applicable to the Cost Centre are available :

- (1) Set up time as described above.
- (2) Depreciation 10% per annum on original cost on each machine. Original cost of each machine is Rs. 13,000.
- (3) Maintenance and repairs per week per machine is Rs. 25
- (4) Consumable stores per week per machine Rs. 36.
- (5) Power—20 units per hour per machine at 40 paise per unit.
- (6) Apportionment to the cost centre

Rent per annum Rs. 3,000

Heat and light per annum Rs. 5,400

Foreman's salary per annum Rs. 7,200

You are required to :

(a) Compute the cost of running one machine for a four-week period and

(b) The machine hour rate.

Solution.

Computation of Cost of running one machine for a four-week period

Standing Charges

	<i>Per Annum</i>
Rent	Rs. 3,000
Heat and light	5,400
Foreman's salary	7,200
Total expenses for 6 machines	15,600

Total expenses for one machine for four-week period

$$\frac{15,600}{6} \times \frac{4}{13} = \text{Rs. 800}$$

Wages— Hours per week = 40
 Hours for 4 weeks = $40 \times 4 = 160$
 160 hrs. (1 × Rs. 10 + 2 × Rs. 5) = Rs. 3200

Bonus— 10% of productive time, i.e., for 144 hrs.
 [144 hrs. (1 × Rs. 10 + 2 × Rs. 5) × 10%

288	3,488
<u>288</u>	<u>4,288</u>

(i) Total standing charges

Machine Expenses

Depreciation (Rs. 13,000 × 4/13) × 10%	400
Repairs and maintenance (Rs. 25 × 4)	100
Consumable stores (Rs. 36 × 4)	144
Powers —No power is consumed during set-up time 144 hrs × 20 units × 40 paise	1,152
	<u>1,796</u>

(ii) Total machine expenses

Total Cost (i) + (ii) 6,084

(b) Machine Hour Rate = Total Cost ÷ Total productive time

= Rs. 6,084 ÷ 144 hrs. = Rs. 42.25 hrs.

Problem 194 (Inter-Process Profit). 'A' Limited produces a product which passes through two processes before it is completed and transferred to finished stock. The following data relate to September, 1990 :

Particulars	Process		Finished Stock
	I	II	
Opening Stock	Rs. 3,000	Rs. 3,600	Rs. 9,000
Direct Materials	6,000	6,300	
Direct Wages	4,480	4,500	
Factory Overheads	4,200	1,800	
Closing Stock	1,480	1,800	4,500
Inter Process profit included in			
Opening Stock		600	3,300

Output of Process I is transferred to Process II at 25% profit on the transfer price and output of Process II is transferred to finished stock at 20% profit on the transfer price. Stocks in process are valued at prime cost. Finished stock is valued at the price at which it is received from Process II. Sales during the period were Rs. 56,000.

Required : Prepare Process Cost Accounts and Finished Stock Account showing the profit element at each stage.

Solution.

Process I Account

	Total	Cost	Profit		Total	Cost	Profit
Opening stock	3,000	3,000	—	Transfer to Process II A/c	21,600	16,200	5,400
Direct materials	6,000	6,000	—				
Direct wages	4,480	4,480	—				
Total	13,480	13,480	—				
Less : C/stock	1,480	1,480	—				
Prime cost	12,000	12,000	—				
Fy. overheads	4,200	4,200	—				
Process Cost	16,200	16,200	—				
Profit 33-1/3 on cost	5,400	—	5,400				
(Working Note 1)	21,600	16,200	5,400		21,600	16,200	5,400

Process II Account

	Total Rs.	Cost Rs.	Profit Rs.		Total Rs.	Cost Rs.	Profit Rs.
Opening stock	3,600	3,000	600	Transferred to Finished Stock A/c	45,000	30,300	14,700
Transfer from Process I	21,600	16,200	5,400				
Direct materials	6,300	6,300	—				
Direct wages	4,500	4,500	—				
	36,000	30,000	6,000				
Less C/stock	1,800	1,500	300				
Prime cost	34,200	28,500	5,700				
Fy. overheads	1,800	1,800	—				
Process Cost	36,000	30,300	5,700				
Profit (25% on cost)	9,000	—	9,000				
(Working Note 2)	45,000	30,300	14,700		45,000	30,300	14,700
$\frac{\text{Profit}}{\text{Total cost}} \times \text{c/stock} = \frac{\text{Rs. 6,000}}{\text{Rs. 36,000}} \times \text{Rs. 1800} = \text{Rs. 300}$							

Finished Stock Account

	Total Rs.	Cost Rs.	Profit Rs.		Total Rs.	Cost Rs.	Profit Rs.
Opening stock	9,000	5,700	3,300	Sales	56,000	33,000	23,000
Transfer from Process II	45,000	30,300	14,700				
	54,000	36,000	18,000				
Less Closing stock	4,500	3,000	1,500 [@]				
Cost of Finished Stock	49,500	33,000	16,500				
Profit	6,500	—	6,500				
	56,000	33,000	23,000		56,000	33,000	23,000

[@] $\frac{\text{Rs. 18,000}}{\text{Rs. 54,000}} \times \text{Rs. 4,500} = \text{Rs. 1,500}$

Working Notes 1. 25% Profit on transfer price is equal to 33-1/3% on cost. Suppose transfer price is Rs. 100 and profits Rs. 25. Thus cost will be Rs. 75. Rs. 25 as a ratio of Rs. 75 is one-third = Rs. 16,200 ÷ 3 = Rs. 5,400.

2. 20% profit on transfer price is equal to 25% on cost. Suppose transfer price is Rs. 100 and profit is Rs. 20. Thus cost will be Rs. 80. Rs. 20 as a ratio of Rs. 80 is one fourth Rs. 36,000 ÷ 4 = Rs. 9,000.

Problem 195. (Marginal Cost vs. Absorption Cost). The following is the standard cost data per unit of product "Flex" manufactured by Gama Limited :

Selling price

Rs. 40

Costs :

Direct Material

Rs. 8

Direct Labour

5

Variable Production Overhead

2

Fixed Production Overheads

5

[Based on a budgeted normal output of 36,000 units per annum]

Variable Selling Overheads

6

Further the fixed selling expenses were Rs. 1,20,000 per annum.

During a particular month, the company produced 2,000 units of the product and sold 1,500 units of the same. There was no opening stock.

You are required to :

(a) Prepare profit statements under :

- (i) Marginal Costing Method and
- (ii) Absorption Costing Method.

(b) Explain the difference in the profits.

Solution : (a) (i) Profit for the month using Marginal Costing Method

Sales (1,500 units × Rs. 40)		Rs. 60,000
<i>Less : Variable Production Costs .</i>		
Material 2,000 × Rs. 8 =	Rs. 16,000	
Labour 2,000 × Rs. 5 =	10,000	
Variable Prod. O.H 2,000 × Rs. 2 =	4,000	
	<u>15</u>	<u>30,000</u>
<i>Less : Closing stock :</i>		
500 units × Rs. 15		<u>7,500</u>
Variable Production costs of saleable units		<u>22,500</u>
<i>Add : Variable selling overheads</i>		
1,500 units × Rs. 6 =		<u>9,000</u>
Total variable production cost of sales		<u>31,500</u>
Contribution		<u>28,500</u>
<i>Less : Fixed cost for the period :</i>		
Production		
(36,000 × Rs. 5) + 12 = Rs. 15,000		
Selling expenses		
(Rs. 1,20,000 + 12) = Rs. 10,000		<u>25,000</u>
Actual Profit (Marginal Costing)		<u><u>3,500</u></u>

Calculation of profit for the month using absorption costing

Sales (1,500 units × Rs. 40) = Rs 60,000

Less : Cost of Sales

Production Cost :

Material 2000 × Rs. 8 =	Rs. 16,000
Labour 2000 × Rs. 5 =	10,000
P. Overhead 2000 × Rs. 2 =	4,000
	<u>30,000</u>
Fixed O.H. absorbed	
2000 × Rs. 5 =	<u>10,000</u>
Total Production Costs	<u>40,000</u>
<i>Less : Closing stock</i>	
500 units × (Rs. 8 + 5 + 2 + 5) =	<u>10,000</u>
Production Cost of saleable units	<u>30,000</u>

Add : *Selling expenses :*

Variable (1,500 × Rs. 6) = Rs. 9,000

Fixed (Rs. 1,20,000 + 12)

= 10,000 19,000

Total Cost of Sales 49,000

Profit before adjustment 11,000

Less : Adjustment for under absorbed overhead

(Refer to Note 1)

5,000

Actual Profit (Absorption Costing) 6,000

(b) Reasons for difference between profit under Absorption Costing and profit under Marginal Costing.

Profit under absorption costing is Rs. 6,000 and profit under marginal costing is Rs. 3,500. The difference in profit is Rs. 2,500 which is due to different prices at which closing stock under the two methods have been valued. Under absorption costing, closing stock of 500 units includes absorbed production fixed overhead of Rs. 2,500 i.e. 500 units × Rs. 5. These costs have been carried over to the next period resulting in increase of profit by Rs. 2,500. Under marginal costing, all fixed costs for the period are charged against profit.

Note : Fixed Production overhead for the period

(36,000 units × Rs. 5) + 12 = Rs. 15,000

Less : Fixed production overhead absorbed by

the production 2,000 units × Rs. 5 = 10,000

Fixed overhead under absorbed 5,000

Problem 196 (Labour Variances). From the following data calculate labour variances :

Standard Labour Hours and Rates per Unit

Grade of Labour	Standard Hours	Rate per Hour
A	20	Rs. 8
B	16	Rs. 5
C	32	Rs. 4

Actual hours for 1000 units actual rate per hour :

Grade of Labour	Actual hours for 1000 units	Rate per Hour
A	18,000	Rs. 10
B	16,800	Rs. 6
C	40,000	Rs. 5

Solution. For calculation of Labour Variances :

L₁ — Actual payment made workers for actual hours worked—

Grade of labour	Actual hours for 1,000 units	Rate per hr.	Amount
A	18,000	Rs. 10	Rs. 1,80,000
B	16,800	6	Rs. 1,00,800
C	40,000	3	1,20,000
	<u>74,800</u>		<u>4,00,800</u>

L₂—Payment involved, if the worker had been paid at standard rate—

Grade	Hrs.	Std. Rate per hr.	Amount
A	18,000	Rs. 8	Rs. 1,44,000
B	16,800	5	84,000
C	40,000	4	1,60,000
	<u>74,800</u>		<u>3,88,000</u>

L₃—Payment involved, if the workers had been used in the proportion of standard gang and the payment had been made at standard rate.

Grade	Hrs.	Std. Rate per hr.	Amount
A	(20/68) × 74,800	× Rs. 8	= Rs. 1,76,000
B	(16/68) × 74,800	× 5	= 88,000
C	(32/68) × 74,800	× 4	= 1,40,800
			<u>4,04,800</u>

L₄—(There are no lost hours)

L₅—Standard variable overhead for production.

Grade	No. of units	Std. hrs.	Rate per hour	Amount
A	1,000	× 20	× Rs. 8	= Rs. 1,60,000
B	1,000	× 16	× 5	= 80,000
C	1,000	× 32	× 4	= 1,28,000
				<u>3,68,000</u>

Wage Rate Variance = L₁ - L₂ = Rs. 4,00,800 - Rs. 3,88,000 = Rs. 12,800 (A)

Wage Gang Variance = L₂ - L₃ = Rs. 3,88,000 - Rs. 4,04,800 = Rs. 16,800 (F)

Wage Yield Variance = L₄ - L₅ = Rs. 4,04,800 - Rs. 3,68,000 = Rs. 36,800 (A)

Wage Efficiency

Variance = L₂ - L₅ = Rs. 3,88,000 - Rs. 3,68,000 = Rs. 20,000 (A)

Alternatively = Rs. 16,800 (F) + Rs. 36,800 (A) = Rs. 20,000 (A)

Wage Cost Variance = L₁ - L₅ = Rs. 4,00,800 - Rs. 3,68,000 = Rs. 32,800 (A)

C.S. Inter December, 1990

Problem 197. (Break-even Analysis). (a) Two companies, ABC Ltd. and XYZ Ltd. sell the same type of product. Their budgeted profit and loss accounts for the year shows the following :

		ABC Ltd. (Rs. '000)	XYZ Ltd. (Rs. '000)
Sales		150	150
Less : Variable cost	120	100	
Fixed cost	15	135	135
Budgeted profit		15	15

You are required to calculate the break-even point of each company. Also state which company is likely to earn greater profit if there is (i) heavy demand; and (ii) poor demand; for its product.

(b) (Selection of Supplier – Use of Cost Indifference Concept) After inviting tenders, two quotations are received as under :

Supplier A — Rs. 2.20 per unit

Supplier B — Rs. 2.10 per unit + Rs. 2,000 fixed charges irrespective of units ordered.

- (i) Calculate the order quantity for which the purchase price per unit will be the same.
- (ii) Select the supplier if the purchase office wants place an order for 15,000 units.

Solution.

1. Statement showing break-even points and P/V ratios of the two companies.

	ABC Ltd. (Rs. '000)	XYZ Ltd. (Rs. '000)
Sales	150	150
Less : Variable Cost	120	100
Contribution	30	50
P/V ratio (%)	20%	33 $\frac{1}{3}$ %
Break-even Sales.	15 + 20% = 75	35 + 33 $\frac{1}{3}$ % = 105

Conclusions :

(i) **Heavy Demand**—In case of heavy demand XYZ Ltd. will make greater profit than ABC Ltd. because its P/V ratio is higher than the P/V ratio of ABC Ltd.

(ii) **Poor Demand**—In case of poor demand ABC Ltd. will earn profits, because it was start earning profit as soon as the sales crosses break-even point of Rs 75,000. In comparison to this XYZ Ltd. will not make any profit when sales excess its B.E. Sales i.e., Rs. 1,05,000.

(b) (i) Suppose the required quantity i.e., Cost Indifference point = x

$$\therefore 2.20x = 2.10x + \text{Rs } 2,000 \text{ or } x = 20,000 \text{ units}$$

\therefore At level of 20,000 units purchase price per unit will be the same.

(ii) If purchase officer wants order for 15,000, then order should be placed with Supplier A. Purchase officer can place order with supplier B to take advantage of lower unit cost only when order is for more than 20,000 units, because at that level fixed cost will be recovered and unit cost will be lower by Re. 0.10.

Problem 198 (a) (Make or Buy). Ridewell Cycles Ltd. purchases 20,000 bells per annum from an outside supplier at Rs. 5 each. The management feels that these be manufactured and not purchased. A machine costing Rs. 50,000 will be required to manufacture the item within the factory. The machine has an annual capacity of 30,000 units and life of 5 years. The following additional information are available :

Material cost per bell	Rs. 2.00
Labour cost	Re. 1.00
Variable overheads	100% of labour cost.

You are required to advise where :

- (i) the company should continue to purchase the bells from the outside supplier or should make them in the factory; and
 - (ii) the company should accept an order to supply 5,000 bells to the market at a selling price of Rs. 4-50 per unit ?
- (b) (Escalation Clause). A contract for construction of building is governed by an escalation clause in respect of prices of steel, cement and stone aggregate. The prices ruling on the date of tender for the building and the actual prices paid by the contractor were as follows :

	<i>On the date of tender</i>	<i>Actual</i>
Steel per ton	Rs. 610	Rs. 675
Cement per ton	100	105
Stone aggregate per 100 c.ft.	40	38

3,00,000 c.ft. of reinforced cement concrete was laid in the building. If 100 lbs. of steel, 2,400 lbs. of cement and 90 c.ft. of stone are the net quantities required to cast 100 c.ft. of RCC and the wastages are 5, 3 and 10 per cent respectively, Calculate the difference in selling price according to the escalation clause. (1 ton = 2,240 lbs.) (Assume the wastage percentage based on the net quantity of material.)

Solution : (i) Statement showing comparative advantages of two options

<i>Purchase from Market</i> <i>20,000 units</i>	<i>Own manufacture</i> <i>20,000 units</i>
Cost for purchase of 20,000 bells from the market	<i>Variable Cost :</i>
20,000 × Rs. 5 1,00,000	Material 20,000 × Rs. 2 = Rs. 40,000
	Labour 20,000 × Rs. 1 = 20,000
	Variable O.H. 100% of labour cost = 20,000
	<u>80,000</u>
	<i>Add : Fixed cost :</i>
	Depreciation (Rs. 50,000 ÷ 5) 10,000
<u>1,00,000</u>	<u>90,000</u>

Conclusion : Company should make bells in the factory. It will lead to increase in profit by Rs. 10,000 per year i.e., Rs. 1,00,000 – 90,000. This represents savings in cost per year.

Note : The opportunity cost of investing Rs. 50,000 elsewhere should also be considered.

(ii) *Variable cost per unit*

Material	Rs. 2-00
Labour	1-00
V. O.H.	1-00

Total Variable Cost	4.00
Contribution	0.50
Selling Price	4.50

The company should accept the order to supply 5,000 bells to the market at a selling price of Rs. 4.50, because selling price is more than variable cost and there is excess capacity of 10,000 units lying unutilized. The will lead to increase in profit by Rs. 2,500 i.e., $5,000 \times \text{Rs. } 0.50$. It is presumed that company is considering this order to supply 5,000 bells after having taken the decision to manufacture 20,000 bells for its own use for which advantage has already been brought out in (i).

(b) Requirement per 100 c.ft of RCC

Net quantities	100 lbs.	2,400 lbs.	90 c. ft.
Wastages	5%	3%	10%
Gross quantities after allowing for wastages	105 lbs.	2472 lbs	99 c.ft.
Requirement for 3,00,000 c.ft.	3,15,000 lbs.	74,16,000 lbs.	2,97,000 c.ft.
Conversion of steel & cement into tons (1 ton = 2240 lbs.)	140.625 tons	3310.7142 tons	2,97,000 c.ft.

Statement showing the difference in selling price according to escalation clause.

Building Materials	Variation in selling price per unit	Gross Quantity 3,00,000 c.ft. of RCC	Difference in selling price
Steel (Ton)	Rs. 65	140.625	Rs. 9,140.63
Cement (Ton)	5	3310.7142	16,553.57
Stone aggregate (100 c.ft)	(-)-2	2,97,000	(-)-5,940.00
Total difference in selling price			19,754.20

Problem 199 (Flexible Budget). The monthly budgets for manufacturing overhead of a concern for two levels of activity were as follows:

Capacity	60%	100%
Budgeted production (Units)	600	1,000
Wages	Rs. 1,200	Rs. 2,000
Consumable stores	900	1,500
Maintenance	1,100	1,500
Power and fuel	1,600	2,000
Depreciation	4,000	4,000
Insurance	1,000	1,000
	9,800	12,000

You are required to :

- indicate which of the items are fixed, variable and semi-variable;
- prepare a budget for 80% capacity; and
- find the total cost (fixed + variable, per unit of output at 60%, 80% and 100% capacity

Solution : (i) Fixed :

Depreciation	—	Since it remains constant at both the given levels.
Insurance	—	Same as above
<i>Variable</i>		
Wages	—	Because it is Rs. 2 per unit at both the given levels
Consumable stores	—	Because it is Rs. 1.50 per unit at both the given levels.
<i>Semi variable</i>		
Maintenance	—	Since it is neither fixed nor the quantum of increase is proportionate to the increase in volume.
Power and Fuel	—	Same as above.

Working Notes

(i) First of all, find out the variable portion of semi-variable overhead.

Maintenance : Variable portion = $\frac{\text{change in overhead}}{\text{change in activity}} = \frac{\text{Rs. 400}}{400} = \text{Rs. 1 per unit}$

Fixed portion = Rs. 1,100 - (600 units × Re. 1) = Rs. 500

At 80% capacity level = (800 units × Re. 1) + Rs. 500 = Rs. 1300

Power and Fuel

Variable portion = $\frac{\text{Rs. 400}}{400} = \text{Rs. 1 per unit.}$

Fixed portion = Rs. 1,600 - (600 units × Re. 1) = Rs. 1,000

At 80% capacity level = (800 units × Re. 1) + Rs. 1,000 = Rs. 1,800

Solution : Budget for 80% capacity level

Budgeted production (80% capacity)	800 units
Wages @ Rs 2 per unit	1,600
Consumable stores @ Rs. 1.5 per unit	1,200
Maintenance— as per above working	1,300
Power and fuel —do—	1,800
Depreciation	4,000
Insurance	1,000
Total	10,900

To sum up, the variable cost per unit works out to Rs. 5.50. It consists of wages – Rs. 2, consumable store – Rs. 1.50, maintenance Re. 1 and power & fuel – Re. 1. The total fixed cost comes to Rs. 6,500 i.e., maintenance Rs. 500 + power & fuel Rs. 1,000 + depreciation Rs. 4,000 + insurance Rs. 1,000.

(iii) Total cost per unit

	Capacity		
	60%	80%	100%
Production (Units)	600	800	1,000

		<i>Rs. per unit</i>	
Variable cost	Rs. 5.50	5.50	5.50
Fixed cost (Rs. 6,500 ÷ Production)	10.83	8.13	6.50
Total	16.33	13.63	12.00

Note : Students should note that total cost (both fixed & variable) *per unit* is required and *not* total cost at different capacity levels.

ICWA Inter December 1990

Problem 200 (a) (EOQ). From the following particulars find out the Economic Order quantity :

- (i) Annual Demand .. 12,000 units
- (ii) Ordering cost .. Rs. 90 per order
- (iii) Inventory carrying cost per annum .. Rs. 15

(b) (Incentive Bonus Scheme). In a manufacturing concern 20 workmen work in a group. The concern follows a group incentive bonus system whereby each workman belonging to the group is paid a bonus on the excess output over the hourly production standard of 250 pieces, in addition to his normal wages at hourly rate. The excess of production over the standard is expressed as a percentage and two-thirds of this percentage is considered to be the share of the workman and is applied on the notional hourly rate of Rs. 6.00 (considered only for purpose of computation of bonus). The output data for a week are stated below :

<i>Days</i>	<i>Manhours worked</i>	<i>Output (In prices)</i>
Monday	160	48,000
Tuesday	172	53,000
Wednesday	164	40,000
Thursday	168	52,000
Friday	160	46,000
Saturday	160	42,000
	984	2,81,000

You are required to :

- (i) Work out the amount of bonus for the week and the average rate at which each workman is to be paid the same.
- (ii) Compute the total wages including bonus payable to Ram Jadav who worked for 48 hours at an hourly rate of Rs. 2.50 and to Francis Williams who worked for 52 hours at an hourly rate of Rs. 3.00.

$$\begin{aligned}
 \text{Solution. EOQ} &= \sqrt{\frac{2 \times \text{Annual Consumption} \times \text{Buying Cost per order}}{\text{Cost of carrying one unit of inventory for one year}}} \\
 &= \sqrt{\frac{2 \times 12,000 \times 90}{15}} \\
 &= 379.47 \text{ or } 380 \text{ units}
 \end{aligned}$$

(b) Actual production per week	2,81,000	pieces
Standard production (250 pieces \times 984)	2,46,000	
Excess production over standard	<u>35,000</u>	
Excess production as a percentage over standard		
production = $(35,000 \div 2,46,000) \times 100 = 14.228$		
Each workman's share	$= \frac{2}{3} \times 14.228 = 9.485\%$	
Bonus on notional hourly rate	$= \text{Rs. } 6 \times 9.485\%$	
	$= \text{Re. } 0.569$	
Amount of bonus	$= 984 \text{ hrs} \times \text{Re. } 0.569 = \text{Rs. } 560$	

(b) *Computation of wages**Ram Judav*

Basic wages : 48 hrs. \times Rs. 2.50	Rs. 120.00
Bonus : 48 hrs. \times Re. 0.569	27.31
Total	<u>147.31</u>

Francis William

Basic wages : 52 \times Rs. 3	156.00
Bonus : 52 \times Re. 0.569	29.59
Total	<u>185.59</u>

Problem 201 (Cost Sheet). *AB & Co.* manufactures two types of pens *P* and *Q*. The cost data for the year ended 30th September, 1990 is as follows :

Direct materials	Rs. 4,00,000
Direct wages	2,24,000
Production	<u>96,000</u>
	<u>7,20,000</u>

It is further ascertained that :

- Direct materials in type *P* cost twice as much direct materials in type *Q*.
- Direct wages for type *Q* were 60% of those for type *P*.
- Production overhead was of same rate for both types.
- Administration overhead for each was 200% of direct labour.
- Selling costs were 50 paise per pen for both types.
- Production during the year :

Type <i>P</i>	..	40,000
Type <i>Q</i>	..	1,20,000
- Sales during the year :

Type <i>P</i>	..	36,000
Type <i>Q</i>	..	1,00,000
- Selling prices were Rs. 14 per pen for type *P* and Rs. 10 per for type *Q*.

Prepare a statement showing per unit Cost of Production, Total Cost, Profit and also Total Sales Value and Profit separately for two types of pen P and Q.

Solution. Statement showing Costs, Sales, and profit for the company as well as for different products.

Production (units)		40,000		1,20,000	
Sales		36,000		1,00,000	
	Total for Company	P		Q	
		Amount	Per Unit	Amount	Per Unit
	Rs.	Rs.	Rs.	Rs.	Rs.
Material (Note 1)	4,00,000	1,60,000	4.00	2,40,000	2.00
Labour (Note 2)	2,24,000	80,000	2.00	1,44,000	1.20
Production O.H. (Note 3)	96,000	24,000	0.60	72,000	0.60
Adm. Overhead (20% of D.L.)	4,48,000	1,60,000	4.00	2,88,000	2.40
Cost of Production of goods manufactured	11,68,000	4,24,000	10.60	7,44,000	6.20
Less : Closing stock	1,66,400	42,400	10.60	1,24,000	6.20
Cost of production of goods sold	10,01,600	3,81,600	10.60	6,20,000	6.20
Selling Costs	68,000	18,000	0.50	50,000	0.50
Cost of Sales	10,69,600	3,99,600	11.10	6,70,000	6.70
Profit	4,34,400	1,04,400	2.90	3,30,000	3.30
Sales	15,04,000	5,04,000	14.00	10,00,000	10.00

Note 1 —Material cost per unit for each product

Suppose material cost of product Q = x

∴ $(2x \times 40,000) + 1,20,000x = \text{Rs. } 4,00,000$ or $x = \text{Rs. } 2$

∴ Material Cost of Product Q = Rs. 2

Material Cost of Production P = Rs. 2 × Rs. 2 = Rs. 4

Note 2—Labour Cost per unit for each product

Suppose labour cost of production P = x

∴ $40,000x + 60\% \text{ of } 1,20,000x = \text{Rs. } 2,24,000$ or $x = \text{Rs. } 2$

∴ Labour Cost of Product P = Rs. 2

∴ Labour Cost of Product Q = 60% of Rs. 2 = Rs. 1.20.

Note 3—Production overhead per unit

Suppose: Production O.H. per unit = x

∴ $40,000x + 1,20,000x = \text{Rs. } 96,000$ or $x = \text{Rs. } 0.60$.

Production O.H. for both the units = Re. 0.60.

For question on comprehensive machine hour rate for the machine shop, please refer to Problem 3-8 on page P 3-12.

Problem 202 (Normal and Abnormal Loss—By-Product Situation). Product ZENU is made by three sequential processes, I, II and III. In process III a by-product arises and after further processing in process XY, at a cost of Rs. 2 per unit, by-product 'XYZ' is produced. Selling and distribution expenses of Re. 1 per unit are incurred in marketing 'XYZ' at a selling price of Rs. 9 per unit.

	Process I	Process II	Process III
Standards provided for .			
normal loss in process of input, of	10%	5%	10%
loss in process, having a scrap			
value, per unit, of	Re. 1	Rs. 3	Rs. 5
For the month of April 1990 the following data are given :			

	Process I	Process II	Process III	Process XY
Output, in units	8,800	8,400	7,000 of ZENU	420 of XYZ
Costs	Rs.	Rs.	Rs.	Total Rs.
Direct Materials : introduced (10,000 units)	20,000			20,000
Direct materials added	6,000	12,640	23,200	41,840
Direct Wages	5,000	6,000	10,000	21,000
Direct Expenses	4,000	6,200	4,080	14,280

Budgeted production overhead for the month was Rs. 84,000.

Absorption is based on a percentage of direct wages.

There are no stocks at the beginning or end of the month.

You are required, using the information given, to prepare accounts for :

(a) each of processes I, II and III ;

(b) process XY.

Solution.

Process I Account

	Units	Amount		Units	Amount
To Direct materials	10,000	Rs. 20,000	By Normal loss-scrap	1,000	Rs. 1,000
" Direct material added		6,000	" @ Re. 1		
" Direct wages		5,000	Abnormal loss @ Rs. 6*	200	1,200
" Direct expenses		4,000	Process II A/c @ Rs. 6	8,800	52,800
" Production overhead (400% of D.W.)		20,000			
	10,000	55,000		10,000	55,000

(*Rs. 55,000 - Rs. 1,000) ÷ 9,000 = Rs. 6 per unit

Process II Account

	Units	Amount		Units	Amount
		Rs.			Rs.
To Process I A/c	8,800	52,800	By Normal loss	440	1,320
" Material added		12,640	" (scrap @ Rs. 3 per unit)		
" Direct wages		6,000	" Process III A/c	8,400	1,00,800
" Direct expenses		6,200	" @ Rs. 6		
" Production overhead (400% of D.W.)		24,000			
" Abnormal Gain A/c @ Rs. 12*	40	480			
	8,840	1,02,120		8,840	1,02,120

*(Rs. 1,01,640 - Rs. 1,320) ÷ 8,360 = Rs. 12 per unit

Process III Account

	Units	Amount		Units	Amount
To Process II A/c	8,400	1,00,800	By Normal loss		Rs.
" Material added		23,200	(scrap @ Rs. 5 per unit)	840	4,200
" Direct wages		10,000	" Abnormal Loss @ Rs. 24*	140	3,360
" Direct expenses		4,080	" Finished product Zenu	7,000	1,68,000
" Production overhead (400% of D.W.)		40,000	@ Rs. 24*		
	8,400	1,78,080	" By-product XY (@ Rs. 6)	420	2,520
				8,400	1,78,080

***Workings**

Cost	Rs 1,78,080	Input	8,400
Less : Scrap	4,200	Less : Normal loss	(-) 840
By-product	2,520	" By-product	(-) 420
	1,71,360		7,140

Rs. 171,360 ÷ 7,140 = Rs. 24 per unit

Process XY Account

	Units	Amount		Units	Amount
		Rs.			Rs.
To Process III A/c	420	2,520	By Product XYZ	420	3,780
" Processing Cost @ Rs. 2		840			
" Selling expenses @ Re. 1		420			
	420	3,780		420	3,780

Note : It is presumed that no profit is made on the by-product XY and whatever is realised from its sales goes to reduce the cost of output of process III i.e., the costs after split-off point as well as the selling and distribution costs are deducted from sale value of by-product and the net amount thus arrived at is credited to process account. This treatment comes under 'non-cost method of accounting by-products'. It is known as "*credit of by-product value less selling and distribution costs and costs incurred on by-product after split off point*".

Problem 203 (P/V Ratio—Objective Type Approach). (a) Explain how would you treat the following items in the accounts of a process costing system :

- (i) Waste ;
- (ii) Scrap.

(b) By noting "P/V will increase or P/V will decrease or P/V will not change", as the case may be, state how the following independent situations will affect the P/V ratio :

- (i) An increase in the physical sales volume ;
- (ii) An increase in the fixed cost ;
- (iii) A decrease in the variable cost per unit ;
- (iv) A decrease in the contribution margin ;
- (v) An increase in selling price per unit ;
- (vi) A decrease in the fixed cost ;
- (vii) A 10% increase in both selling price and variable cost per unit ;
- (viii) A 10% increase in the selling price per unit and 10% decrease in the physical sales volume .

- (ix) A 50% increase in the variable cost per unit and 50% decrease in fixed cost ; and
 (x) An increase in the angle of incidence.

Solution : (a) Please refer to the book "Advanced Cost and Management Accounting—Text" by V.K. Saxena and C.D. Vashist

- (b) (i) P/V Ratio will not change.
 (ii) P/V Ratio will not change.
 (iii) P/V Ratio will increase.
 (iv) P/V Ratio will decrease.
 (v) P/V Ratio will increase.
 (vi) P/V Ratio will not change.
 (vii) P/V Ratio will not change.
 (viii) P/V Ratio will increase.
 (ix) P/V Ratio will decrease.
 (x) P/V Ratio will increase.

Problem 204 (Break-even Analysis) (a) Describe briefly three different types of standard which may be used as the basis for a standard costing system.

(b) Two competing companies HERO Ltd. and ZERO Ltd. sell the same type of product in the same market. Their forecasted profit and loss accounts for the year ending December 1990 are as follows :

	HERO Ltd.		ZERO Ltd.	
Sales	Rs.	Rs. 5,00,000	Rs.	Rs. 5,00,000
Less : Variable cost of Sales	4,00,000		3,00,000	
Fixed Costs	<u>50,000</u>	<u>4,50,000</u>	<u>1,50,000</u>	<u>4,50,000</u>
Forecasted Net Profit before tax		<u>50,000</u>		<u>50,000</u>

You are required to state which company is likely to earn greater profits in conditions of :

- (a) low demand and
 (b) high demand.

Solution (a) Please refer to the book "Advanced Cost and Management Accounting—Text" by V.K. Saxena and C.D. Vashist.

(b) Statement summarising the data.

	Hero Ltd.	Zero Ltd.
Sales	Rs. 5,00,000	Rs. 5,00,000
Less : Variable Cost	4,00,000	3,00,000
Contribution	<u>1,00,000</u>	<u>2,00,000</u>
P/V Ratio	$1/5 \times 100 = 20\%$	$2/5 \times 100 = 40\%$
B.E. Sales	BES $\times 20\% = \text{Rs. } 50,000$ or BES = Rs. 2,50,000	BES $\times 40\% = \text{Rs. } 1,50,000$ or BES = Rs. 3,75,000

(a) In case of lower demand. Hero Ltd. will earn greater profits than Zero Ltd. Hero Ltd. will start making profit as soon as the level of sales crosses Rs.

2,50,000 (i.e. B.E. Sales). In case of low demand, the product with lower P/V ratio will earn greater profits.

(b) *In case of high demand*, Zero Ltd. will earn greater profits than Hero Ltd. because P/V Ratio of Zero Ltd. is more than the P/V Ratio of Hero Ltd.

Problem 205 (Unit Costing). (a) Discuss the importance of key factors or limiting factors in an organisation.

(b) A firm has purchased a plant to manufacture a new product, the cost data for which is given below :

Estimated Annual Sales	24,000 units
Estimated Costs :	
Material	Rs. 4.00 per unit
Direct Labour	Rs. 0.60 per unit
Overheads	Rs. 24,000 per year
Administrative Expenses	Rs. 28,800 per year
Selling Expenses	15 % of Sales.

Calculate the selling price if profit per unit is Rs. 1.02.

Solution (a) Please refer to "Advanced Cost and Management Accounting—Text" by V.K. Saxena and C.D. Vashist.

(b) <i>Estimated Costs</i>	<i>Rs. Per Unit</i>
Materials	Rs. 4.00
Direct Labour	0.60
Overheads (Rs. 24,000 ÷ 24,000 units)	1.00
Administrative Overhead (Rs. 28,800 ÷ 24,000 units)	1.20
Cost of production	6.80
Suppose selling price per unit	= x
Selling expenses (15% of S.P.)	= 0.15 x
Selling Price = Cost of production + Selling Expenses + Profit	
x = Rs. 6.80 + 0.15 x + Rs. 1.02	
or x = Rs. 9.20	Therefore selling Price = Rs. 9.20

Verification

Cost of production	= Rs. 6.80
Selling expenses (15% of Rs. 9.20)	1.38
Profit	1.02
Selling Price	9.20

Alternative Solution

This can also be solved by Marginal Costing Approach :

Contribution required for the year :

Profit 24,000 × Rs. 1.02	=	Rs. 24,480
Overhead		24,000
Adm. Exp.		28,800
Total contribution		77,280

Suppose Selling Price = x .

Selling Expenses = $0.15x$

Variable Cost = Rs. 4 + $0.60 =$ Rs. 4.60

Incorporating these values in basic Marginal Cost Equation i.e., $S - V = F + P$.

$24,000x - \{4.60 \times 24,000 + 0.15x \times 24,000\} = 77,280$

$\therefore x =$ Rs. 9.20.

or Selling Price = Rs. 9.20.

Problem 206 (Overhead Variances). (a) The budget for a period indicates :

Works Overhead Fixed	Rs. 50,000
Works Overhead Variable	Rs 1,50,000
Normal Activity	100%

During the period the actual activity was only 70% of the normal load for a total expenditure of Rs. 1,50,000. What are the budget and volume variance ?

(b) Determine the budget and capacity variances from the following data :

Estimated Factory Overhead	Rs. 25,000
Estimated Direct Labour Hours	5,000
Actual Overhead Expenses	Rs. 26,500
Applied Overhead Expenses	Rs. 22,500

Solution. (a) for Variable Overhead Variances.

FO_1/VO_1 — Actual Overhead Rs. 1,50,000

FO_2/VO_2 — Budgeted fixed overhead for the period $50,000 + 0.70 (1,50,000)$ 1,55,000

FO_3/VO_3 — Standard Variable overhead for production $(2,00,000/100) \times 70$ 1,40,000

Budgeted Overhead Variance

Expenditure or Budgeted Variance = $FO_1 - FC_2 =$ Rs. 1,50,000 – Rs. 1,55,000
= Rs. 5,000 (A)

Volume Variance = $FO_2 - FO_3 =$ Rs. 1,55,000 – Rs. 1,40,000 = Rs. 15,000 (F)

Total Overhead Variance = $FO_1 - FO_3 =$ Rs. 1,50,000 – Rs. 1,40,000
= Rs. 10,000 (F)

Alternatively = Expenditure Variance + Volume Variances

= Rs. 5,000 (A) + Rs. 15,000 (F)

= Rs. 10,000 (F)

(b) FO_1 — Actual Overhead Expenditure = Rs. 26,500

FO_2 — Budgeted Fixed OH 25,000

FO_3 — Applied Overhead i.e. Overhead for hours available 22,500

Budget Variance = $FO_1 - FO_2 =$ Rs. 26,500 – 25,000 = Rs. 1,500 (A)

Capacity Variance = $FO_2 - FO_3 =$ Rs. 25,000 – Rs. 22,500 = Rs. 2,500 (A)

Problem 207 (Return on capital Employed). Find out the selling price of an article whose costs for production and sale of 1,00,000 units are :

Material	Rs. 50,000
Labour	40,000
Overheads	1,60,000

The fixed portion of Capital Employed is Rs. 50,000 and the varying portion is 40% of sales turnover. A profit of 8% net on capital employed after payment of tax at 40% of the earnings is desired.

Solution : Total Cost = Rs. 50,000 + Rs. 40,000 + Rs. 1,60,000 = Rs. 2,50,000.

Cost per unit = Rs. 2.50.

Suppose the selling price per unit = x

Sales turnover 1,00,000 x

Variable portion of capital employed = $0.4 (1,00,000x)$ or $40,000 x$

Fixed portion of capital employed Rs. 50,000

Total capital employed = (Rs. 50,000 + $40,000 x$) or capital employed per unit = $0.5 + 0.4 x$

Suppose Gross Profit = Rs. 100

Tax = 40

Profit after tax 60

Ratio of Gross Profit to Net Profit after tax = $100 + 60 = 1.6667$

Therefore 8% Pretax profit = $1.6667 \times 8\% = 13.3336\%$ Post tax profit

Post tax profit on per unit capital employed = (Re. $0.5 + 0.4 x$) 13.3336%

Post tax profit per unit = $0.07 + 0.05 x$

Unit Selling Price = Total cost per unit + profit on capital employed per unit

$$x = \text{Rs. } 2.50 + 0.07 + 0.05 x$$

$$0.95x = 2.57 \quad \text{or } x = 2.705 \quad \text{say } 2.71$$

Check : Sales per unit Rs. 2.71

Less : Total cost 2.50

Profit 0.21

Fixed portion of capital employed = Re. 0.50

Variable portion (40% of Sales) 1.084

Total capital employed 1.584

Post tax return @ 13.3336% 0.21 (proved)

C.A. Final November 1990

Problem 208 (Materials and Sales Variances). Standcost Corporation produces three products : A, B and C. The master budget called for the sale of 10,000 units of A at Rs. 12, 6,000 units of B at Rs. 15 and 8,000 units of C at Rs. 9. In addition, the standard variable cost for each

product was Rs. 7 for A, Rs. 9 for B and Rs. 6 for C. In fact, the firm actually produced and sold 11,000 units of A at Rs. 11.50, 5,000 units of B at Rs. 15.10 and 9,000 units of C at Rs. 8.55.

The firm uses two inputs to produce each of the product X and Y. The standard price per unit of material X is Rs. 2 and for a unit of material Y is Re. 1. The materials budgeted to be used for each product were :

<i>Products</i>	<i>Materials</i>	
	<i>X</i> (units)	<i>Y</i> (units)
A	2	3
B	4	1
C	1	4

The firm actually used 54,000 units of X at cost of Rs. 1,09,620 and 72,000 units of Y at a cost of Rs. 73,000.

Required : Determine the mix, quantity and rate variances for sales as well as the yield, mix and price variances for materials.

Solution

For Material Cost Variances.

M₁ — Actual Cost of material used

X	54,000 units at actual Price	Rs. 1,09,620
Y	72,000 units at actual Price	73,000
		<u>1,82,620</u>

M₂ — Standard Cost of material used

Y	54,000 units × Rs. 2 =	1,08,000
Y	72,000 units × Rs. 1 =	72,000
		<u>1,80,000</u>

Working for step M₃

Material Mix for the production as per standard

<i>Products</i>	<i>Units</i>	<i>X units</i>	<i>Y units</i>	<i>Total Units</i>
A	11,000	22,000	33,000	55,000
B	5,000	20,000	5,000	25,000
C	9,000	9,000	36,000	45,000
		<u>51,000</u>	<u>74,000</u>	<u>1,25,000</u>

M₃ — Material Cost if material had been used in standard proportion .

X	— (51,000 ÷ 1,25,000) × 1,26,000 × Rs. 2	Rs. 1,02,816
Y	— (74,000 ÷ 1,25,000) × 1,26,000 × Rs. 1	= 74,592
		<u>1,77,408</u>

M₄ — Standard material Cost of Output

X	51,000 × Rs. 2	=	1,02,000
Y	74,000 × Rs. 1	=	74,000
			<u>1,76,000</u>

$$\text{Material Price Variance} = M_1 - M_2 = \text{Rs. } 1,82,620 - \text{Rs. } 1,80,000 \\ = \text{Rs. } 2,620 \text{ (A)}$$

$$\text{Material Mix Variance} = M_2 - M_3 = \text{Rs. } 1,80,000 - \text{Rs. } 1,77,408 \\ = \text{Rs. } 2,592 \text{ (A)}$$

$$\text{Material Yield Variance} = M_3 - M_4 = \text{Rs. } 1,77,408 - \text{Rs. } 1,76,000 \\ = \text{Rs. } 1,408 \text{ (A)}$$

$$\text{Material Cost Variance} = M_1 - M_4 = \text{Rs. } 1,82,620 - \text{Rs. } 1,76,000 \text{ (A)} \\ = \text{Rs. } 6,620 \text{ (A)}$$

$$\text{Alternatively} = 2620 \text{ (A)} + 2592 \text{ (A)} + 1408 \text{ (A)} = 6,620 \text{ (A)}$$

For Sales Variances :

Sales variances can be found out by sales value method as well as sales margin method. Here sales value method has been used.

SV₁ — Actual Sales Value realised

A	11,000 units	× Rs. 11.50	= Rs. 1,26,500
B	5,000 units	× Rs. 15.10	= 75,500
C	9,000 units	× Rs. 8.55	= 76,950
	<u>25,000 units</u>		<u>2,78,950</u>

SV₂ — Standard Sales Value of actual sales

A	11,000 units	× Rs. 12	= Rs. 1,32,000
B	5,000 units	× Rs. 15	= 75,000
C	9,000 units	× Rs. 9	= 81,000
	<u>25,000 units</u>		<u>2,88,000</u>

SV₃ — Standard Sales Value of actual sales, if the sales had been in the ratio of standard sales mix.

A	— (10,000 + 24,000) × 25,000 × Rs. 12	= Rs. 1,25,000
B	— (6,000 + 24,000) × 25,000 × Rs. 15	= 93,750
C	— (8,000 + 24,000) × 25,000 × Rs. 9	= 75,000
		<u>2,93,750</u>

SV₄ — Standard Sales Value as per standard

A	— 10,000 units	× Rs. 12	= Rs. 1,20,000
B	— 6,000 units	× Rs. 15	= 90,000
C	— 8,000 units	× Rs. 9	= 72,000
			<u>2,82,000</u>

$$\text{Sales Value Price Variance} = SV_1 - SV_2 = \text{Rs. } 2,78,950 - \text{Rs. } 2,88,000 \\ = \text{Rs. } 9,050 \text{ (A)}$$

$$\text{Sales Value Mix Variance} = SV_2 - SV_3 = \text{Rs. } 2,88,000 - \text{Rs. } 2,93,750 \\ = \text{Rs. } 5,750 \text{ (A)}$$

$$\text{Sales Value Quantity Variance} = SV_3 - SV_4 = \text{Rs. } 2,93,750 - \text{Rs. } 2,82,000 \\ = \text{Rs. } 11,750 \text{ (F)}$$

$$\text{Sales Value Volume Variance} = SV_2 - SV_4 = \text{Rs. } 2,88,000 - \text{Rs. } 2,82,000 \\ = 6,000 \text{ (A)}$$

$$\text{Sales Value Variance} = SV_1 - SV_2 = \text{Rs. } 2,78,950 - \text{Rs. } 2,82,000 \\ = \text{Rs. } 3,050 \text{ (A)}$$

Problem 209 (Average Method—Process Loss takes place in the beginning). A chemical company carries on production operations in two processes. Materials first pass through Process I, where a compound is produced. A loss in weight takes place at the start of processing. The following data, which can be assumed to be representative, relates to the month just ended :

Quantities :	Rs.
• Material input	2,00,000
Opening Work-in-process (half processed)	40,000
Work completed	1,60,000
Closing Work-in-process (two thirds completed)	30,000

Costs :	Rs.
Material input	75,000
Processing costs	1,02,000
Opening Work-in-process :	
Materials	20,000
Processing costs	12,000

Normal process loss in quantity may be assumed to be 20% of material input

Any quantity of the compound can be sold for Rs. 1.60 per kg. Alternatively, it can be transferred to Process II for further processing and packing to be sold as Supercomp, for Rs. 2.00 per kg. Further materials are added in Process II which yield two kgs of Supercomp for every kg of the Process I compound used.

Of the 1,60,000 kgs per month of work completed in Process I, 40,000 kgs are sold as compound and 1,20,000 kg are passed through Process II for sale as Supercomp. Process II has facilities to handle up to 1,60,000 kgs of compound per month if required. The monthly costs incurred in Process II (other than the cost of the compound) are :

	1,20,000 kgs of compound inputs	1,60,000 kgs of compound inputs
	Rs.	Rs.
Materials	1,20,000	1,60,000
Processing Costs	1,20,000	1,40,000

Required :

(a) Determine, using the average cost method, the cost per kg. of the compound in Process I and the value of both completed and closing work-in-process for the month just ended.

(b) Is it worth while processing 1,20,000 kgs. of compound further ?

(c) Calculate the minimum acceptable selling price per kg. if a potential buyer could be found for the additional output of Supercomp that could be produced with the remaining compound.

Solution.**Process I****(a) Statement of Equivalent Production**

Input		Output		Equivalent Units			
				Material	Conversion Cost		
Particulars	Units (kg.)	Particulars	Units kg.	Units	% completion	Units	% of completion
Opening WIP	40,000	Normal loss	40,000	—	—	—	—
New material introduced	2,00,000	Units Introduced & completed	1,60,000	1,60,000	100%	1,60,000	100%
		Abnormal loss	10,000	10,000	100%	10,000	100%
		Closing Work in progress	30,000	30,000	100%	20,000	2/3rd
	<u>2,40,000</u>		<u>2,40,000</u>	<u>2,00,000</u>		<u>1,90,000</u>	

Process I**Statement of Cost for Each Element**

Elements of Costs	Cost of opening WIP	Cost in Process	Total Cost	Equivalent units Kg.	Cost per unit Rs.
Material	Rs. 20,000	Rs. 75,000	Rs. 95,000	2,00,000	0.475
Conversion cost	12,000	1,02,000	1,14,000	1,90,000	0.600
	<u>32,000</u>	<u>1,77,000</u>	<u>2,09,000*</u>		<u>1,075</u>

Statement of Apportionment of Cost

Units Completed	Elements	Equivalent Units (kg.)	Cost per unit	Cost Rs.	Total Cost
Work completed	Material	1,60,000	0.475	76,000	1,72,000
	Conversion Cost	1,60,000	0.600	<u>96,000</u>	
Value of WIP completed	Material	30,000	0.475	14,250	26,250
	Conversion	20,000	0.600	<u>12,000</u>	

Note : The work of abnormal loss can also be found out like "work completed, but it has not been asked in the question.

(b) There can be two approaches to this problem

Approach I—Total cost and revenue approach.

Statement showing comparative data to decide whether 1,20,000 kg. of compound should be processed further.

Alternative I		Alternative II	
Sell immediately after Process I		Process further	
Sales	1,20,000 × Rs. 1.60 = Rs. 1,92,000	Sales	2,40,000 × Rs. 2.00 = Rs. 4,80,000
Less : Cost from Process I		Cost from Process I	
1,20,000 × Rs. 1.075 =	1,29,000	1,20,000 × Rs. 1.075	
		= Rs. 1,29,000	

		Material in Process II	1,20,000	
		Processing Cost in		
		Process II	1,20,000	3,69,000
Profit	<u>63,000</u>	Profit		<u>1,11,000</u>

Conclusion : Company should take decision to process further. It will increase profit by Rs. 48,000 i.e., Rs. 1,11,000 – Rs. 63,000.

Approach 2—Incremental cost and incremental revenue

Incremental Revenue :

Sales	$1,20,000 \times \text{Rs. } 2$	Rs. 2,40,000	
	$1,20,000 \times (2 - 1.60) =$	<u>Rs. 48,000</u>	Rs. 2,88,000

Less Incremental Costs

Materials in Process II	Rs. 1,20,000	
Processing Costs in Process II	<u>1,20,000</u>	<u>2,40,000</u>
Incremental profit due to the processing		<u>48,000</u>

Conclusion. As there is an incremental profit due to decision to process, the company should process the compound.

(c) Calculations of minimum selling price per kg :

Cost of processing remaining 40,000 further

Material (Rs. 1,60,000 – Rs. 1,20,000)	=	Rs. 40,000
Processing Cost (Rs. 1,40,000 – 1,20,000)	=	20,000
Cost from Process I relating to 40,000 units		
$40,000 \times \text{Rs. } 1.075$	=	43,000
Opportunity cost or benefits foregone of the decision to process 40,000 units further		
$40,000 \times (1.60 - 1.075)$	=	<u>21,000</u>
Cost which must be borne by addition units		<u>1,24,000</u>
Additional quantity of Supercon for this decision to further process 40,000 units $(40,000 \times 2)$	=	80,000
\therefore Minimum selling price per kg	=	$1,24,000 + 80,000$
	=	Rs. 1.55

Problem 210 (Break-even Analysis). Paramount Food Products is a new entrant in the market for chocolates. It has introduced a new product 'Sweetie'. This is a small rectangular chocolate bar. The bars are wrapped in aluminium foil and packed in attractive cartons containing 50 bars. A carton, is therefore, considered the basic sales unit. Although management had made detailed estimates of costs and volumes prior to undertaking this venture, new projections based on actual cost experience are now required.

Income Statements for the last two quarters are each thought to be representative of the costs and productive efficiency we can expect in the next few quarters. There were virtually no inventories on hand at the end of each quarter. The income statements reveal the following :—

	First Quarter	Second Quarter
Sales :	Rs.	Rs.
50,000 \times Rs. 24	12,00,000	

70,000 × Rs. 24	—	16,80,000
Cost of Goods Sold	7,00,000.	8,80,000
Gross Margin	5,00,000	8,00,000
Selling and Administration	6,50,000	6,90,000
Net Income (Loss) before taxes	(1,50,000)	1,10,000
Tax (negative)	(60,000)	44,000
Net Income (Loss)	(90,000)	66,000

The firm's overall marginal and average income-tax rate is 40%. This 40% figure has been used to estimate the tax liability arising from the chocolate operations.

Required :

- Management would like to know the break-even point in terms of quarterly carton sales for the chocolates.
- Management estimates that there is an investment of Rs. 30,00,000 in this product line. What quarterly carton sales and total revenue are required in each quarter to earn an after-tax return of 20% per annum on investment ?
- The firm's marketing people predict that if the selling price is reduced by Rs. 1.50 per carton (Rs. 0.03 off per chocolate bar) and a Rs. 1,50,000 advertising campaign among school children is mounted, sales will increase by 20% over the second quarter sales. Should the plan be implemented ?

Solution.

- For determining Break-even point, it is necessary to find out fixed cost

For Variable and Fixed Manufacturing Cost :

$$\text{Variable Cost} = \frac{\text{Change in Cost}}{\text{Change in activity}} = \frac{\text{Rs. 1,80,000}}{20,000} = \text{Rs. 9 per unit.}$$

$$\text{Total Manufacturing cost at a level of 5,000 cartons} = \text{Rs. 7,00,000}$$

$$\text{Less Variable Manufacturing Cost } 50,000 \times \text{Rs. 9} = 4,50,000$$

$$\text{Fixed Manufacturing Cost for the quarter} = 2,50,000$$

For Variable and Fixed Selling Administration Cost :

$$\text{S. \& Admn. Cost} = \frac{\text{Variable Change in Cost}}{\text{Change in activity}} = \frac{\text{Rs. 6,90,000} - \text{Rs. 6,50,000}}{20,000} = \text{Rs. 2 per unit}$$

$$\text{Total Selling and Admn. Cost at a level of 50,000 cartons} = \text{Rs. 6,50,000}$$

$$\text{Less Variable Selling \& Admn. Cost } 50,000 \times 2 = 1,00,000$$

$$\text{Fixed Selling and Admn. Cost} = 5,50,000$$

$$\therefore \text{Total Variable cost per unit} = \text{Rs. 9} + \text{Rs. 2} = \text{Rs. 11.00.}$$

$$\text{P/V ratio} = \text{Rs. 24} - 11 = 13/24$$

$$\text{Total fixed cost} = 2,50,000 + \text{Rs. 5,50,000} = \text{Rs. 8,00,000.}$$

We know that $\therefore \text{BES} \times \text{P/V ratio} = \text{Fixed Cost}$

$$\text{or } \text{BES} \times 13/24 = \text{Rs. 8,00,000} \text{ or } \text{BES} = \text{Rs. 14,76,923}$$

$$\text{or } \text{BES} = 14,76,923 \div 24 = 61539 \text{ cartons}$$

(b) Management want 20% per annum on investment of Rs. 30,00,000.

$$\begin{aligned}\text{Expected quarterly profit after tax} &= \text{Rs. } 30,00,000 \times 0.20 \times (3/12) \\ &= \text{Rs. } 1,50,000\end{aligned}$$

Suppose profit	= Rs. 100
∴ Tax	40
Profit after tax	<u>60</u>

$$\begin{aligned}\therefore \text{Expected quarterly profit before tax} &= (\text{Rs. } 1,50,000 + 60) \times 100 \\ &= \text{Rs. } 2,50,000\end{aligned}$$

$$\begin{aligned}\therefore \text{Contribution expected in each quarter} &= \text{Profit} + \text{Fixed Cost} \\ &= \text{Rs. } 2,50,000 + \text{Rs. } 8,00,000 = \text{Rs. } 10,50,000\end{aligned}$$

$$\therefore S \times P/V \text{ ratio} = \text{Rs. } 10,50,000 = (10,50,000 \times 24) \div 13$$

$$\therefore \text{Required Sales per quarter} = \text{Rs. } 19,38,461$$

$$\text{Required Sales per quarter in units} = \text{Rs. } 19,38,461 \div 24 = 80,769 \text{ cartons}$$

(c) New Selling Price per carton = Rs. 24 - 1.50 = Rs. 22.50

Variable Cost remains same = Rs. 11 per carton

$$\text{Sales as per revised plan } 84,000 \times \text{Rs. } 22.50 = \text{Rs. } 18,90,000$$

$$\text{Less : Variable Cost } 84,000 \times 11 = \underline{9,24,000}$$

$$\text{Contribution during the quarter as per revised plan} = 9,66,000$$

Less Fixed cost during the quarter :

Existing fixed cost	Rs. 8,00,000	
Additional Adv. Exp.	<u>1,50,000</u>	9,50,000

$$\text{Profit before tax} = 16,000$$

$$\text{Tax } (16,000 \times 0.40) = \underline{6,400}$$

$$\text{Profit after tax as per proposed plan} = \underline{\underline{9,600}}$$

But the existing profit after tax during second quarter in Rs. 66,000. Therefore the plan should not be implemented.

Problem 211 (Cash Budget). On 30th September, 1990, the Balance of Melodies Pvt. Ltd., retailers of musical instruments, was as under :

	Rs.		Rs.
Ordinary Shares of		Equipment (at cost)	20,000
Rs. 10 each fully Paid	20,000	Less : Depreciation	<u>5,000</u>
Reserves and Surplus	10,000		15,000
Trade Creditors	40,000	Stock	20,000
Proposed Dividend	15,000	Trade Debtors	15,000
		Balance at Bank	<u>35,000</u>
	<u>85,000</u>		<u>85,000</u>

The company is developing a system of forward planning, and on 1st October, 1990 it supplies the following information :

<i>Month</i>	<i>Credit Sales</i>	<i>Cash Sales</i>	<i>Credit Purchases</i>
	<i>Rs.</i>	<i>Rs.</i>	<i>Rs.</i>
September 1990 (actual)	15,000	14,000	40,000
October 1990 (budget)	18,000	5,000	23,000
November 1990 (budget)	20,000	6,000	27,000
December 1990 (budget)	25,000	8,000	26,000

All trade debtors are allowed one months credit and are expected to settle promptly. All trade creditors are paid in the month following delivery.

On 1st October 1990, all the equipment was replaced at a cost of Rs 30,000. Rs. 14,000 was allowed in exchange for the old equipment and a net payment of Rs. 16,000 was made. Depreciation is to be provided at the rate of 10% per annum.

The proposed dividend will be paid in December 1990.

The following expenses will be paid :

Wages Rs. 3,000 per month

Administration Rs. 1,500 per month

Rent Rs. 3,600 for the year to 30th September 1991 (to be paid in October 1990).

The gross profit percentage on sales is estimated at 25%.

You are required :

- to prepare a Cash Budget for the month of October, November and December.
- to prepare Income Statement for the three months ended 31st December, 1990.

Solution :

(a) *Cash Budget for October, November and December 1990.*

	<i>October</i>	<i>November</i>	<i>December</i>
	<i>Rs.</i>	<i>Rs.</i>	<i>Rs.</i>
Opening balance of bank (Overdraft)	35,000	(9,100)	(12,600)
Cash Inflows			
Sales :			
From cash sales of current month	5,000	6,000	8,000
From credit sales of previous month	15,000	18,000	20,000
Total Receipts (A)	<u>55,000</u>	<u>14,900</u>	<u>15,400</u>
Cash Outflows :			
Creditors for purchase of the preceding month	40,000	23,000	27,000
Equipment	16,000	—	—
Wages	3,000	3,000	3,000
Administration	1,500	1,500	1,500
Rent	3,600	—	—
Dividend	—	—	15,000
Total Payment (B)	<u>64,100</u>	<u>27,500</u>	<u>46,500</u>
Closing Balance (Overdraft) (A – B)	<u>(9,100)</u>	<u>(12,600)</u>	<u>(31,100)</u>

(b) Budgeted Income Statement for three months ending 31st December 1990Sales Rs. 82,000**Less : Cost of Goods sold :**

Material—O/stock	Rs. 20,000	
Add Purchases (23,000 + 27,000 + 26,000)	76,000	
	<u>96,000</u>	
Less Closing stock	43,500	
Cost of material consumed	<u>52,500</u>	
Wages (3,000 × 3)	9,000	61,500

Gross Profit 20,500

Less: Rent [3,600 × (3/12)]	900	
Administration (1,500 × 3)	4,500	
Depreciation [3,000 × (3/12)]	750	
Loss on sale of asset (Rs. 15,000 – Rs. 14,000)	1,000	7,150

Net Profit : 13,350**Working Notes :****(i) Total Sales**

	Credit Sales	Cash Sales	Total
	Rs.	Rs.	Rs.
October 1990	18,000	5,000	23,000
November 1990	20,000	6,000	26,000
December 1990	25,000	8,000	33,000
	<u>63,000</u>	<u>19,000</u>	<u>82,000</u>

For Cost of Sales :

(ii) Sales for the quarter	Rs. 82,000
Less Gross Profit 25% of Sales	20,500
Cost of Sales	<u>61,500</u>

(iii) For Material Consumed :

Cash of Sales for three month	Rs. 61,500
Less Wages (3000 × 3)	9,000
Cost of Material Consumed	<u>52,500</u>

(iv) For closing stock of material :

Opening stock of material	Rs. 20,000
Add Purchases (23,000 + 27,000 + 26,000)	76,000
	<u>96,000</u>
Less Material consumed	52,500
Closing stock of material	<u>43,500</u>

[For question on letting out theatre accommodation please refer problem A20 on page A47]

CA Final December 1990

Problem 212 (Responsibility Accounting). (a) What is Responsibility Accounting? Distinguish between a cost centre and a profit centre.

(b) Automech Accessories Ltd. specialises in the production of a single component used in automobile transmission. Engineering estimates and financial forecasts have yielded the following standard costs per unit :

Material (10 kgs at Rs. 3 per kg)	Rs. 30
Labour (2 hours at Rs. 12 per hour)	24
Variable Overhead (2 hours at Rs. 2 per hour)	4
Fixed Overhead (2 hours at Rs. 4 per hour)	8
Total Standard Cost per unit	66

The total flexible budget for factory overhead indicates that the company expects total overhead to be Rs. 1,20,000 at a standard activity level of 20,000 direct labour hours.

Actual expenditure for the period are listed below. There were no beginning or ending inventories of materials.

Materials :	Rs. 4,50,000
Labour	3,32,000
Variable Overhead	48,000
Fixed Overhead	82,000
Total cost	9,12,000
Actual units produced	12,000
Actual cost per unit	76

When the shop foreman saw that the actual cost was Rs. 76 per unit, he explained that this operation had performed beyond expectations and that others in the organisation were responsible for the large cost over-run. For example, he pointed out that the purchase department had paid Rs. 3.60 for materials that were expected to cost only Rs. 3.00 per kg., and that the personnel department had conceded to a wage rate increase, resulting in the average wage rate being Rs. 13.28 rather than Rs. 12. The foreman remarked : "I am responsible for all quantity and efficiency variances, but it is clear that we have done our jobs, or else the cost over-run would be even larger than it is."

Required :

Analyse the situation and indicate how much of the responsibility for the large cost over-runs, if any, rests with the shop floor foreman.

Solution (a) Please refer to "Advanced Cost and Management Accounting — Text" by V.K. Saxena and C.D. Vashist.

(b) *Variance Analysis*

For Material Variance

M ₁ —Actual Cost of material used (1,25,000* × Rs. 3.60)	Rs. 4,50,000
M ₂ —Standard Cost of material used (1,25,000 × Rs. 3.00)	3,75,000
M ₃ —There is no mix variance	Nil

M₄—Standard material cost of output (12,000 units × Rs. 30) 3,60,000
Material Price Variance = M₁ – M₂ = Rs. 4,50,000 – 3,75,000 = Rs. 75,000 (A)
Material Usage or Volume Variance = M₂ – M₄ = Rs. 3,75,000 – Rs. 3,60,000
= Rs. 15,000 (A)

Statement showing responsibility of shop foreman for quantity and efficiency variances.

<i>Details</i>	<i>Rate or Expenditure Variances</i>	<i>Quantity or Efficiency Variance</i>	<i>Cost</i>
<i>Actual Cost</i>			Rs. 9,12,000
Material exp. variance	Rs. 75,000 (A)		
Material usage variance		Rs. 15,000 (A)	
Wage rate variance	32,000 (A)		
Wage efficiency variance		12,000 (A)	
Variable O.H. exp. variance	2,000 (F)		
Variable O.H. efficiency variance		2,000 (A)	
Fixed overhead exp. variance	2,000 (A)		
Fixed overhead capacity variance		20,000 (F)	
Fixed overhead efficiency variance		4,000 (A)	
	1,07,000 (A)	13,000 (A)	1,20,000 (A)
<i>Standard cost (12,000 × Rs. 66)</i>			7,92,000

Conclusion—The analysis of the situation indicates that shop foreman is responsible for cost over-runs of Rs. 13,000 *i.e.*, for unfavourable quantity and efficiency variance.

Problem 213 (Marginal Costing vs. Absorption Costing).
The following information relates to the first two years of operation for a newly created division of a manufacturing company :

Standard Manufacturing Costs

	<i>Unit Costs</i>
Direct Material	Rs. 4-00
Direct Labour	4-00
Variable Manufacturing Overhead	2-00
Total Variable Manufacturing Cost	10-00
Fixed Manufacturing Cost	4-00
Total Manufacturing Cost	14-00

Standard capacity, 2,00,000 units

Selling Price Rs. 25 per unit

Selling and administration expenses :

Variable Rs. 2-00 per unit of output

Fixed Rs. 3,00,000.

Production and Sales Statistics :

	Year 1	Year 2
Units produced	2,20,000	1,70,000
Units sold	1,80,000	2,00,000
Inventory change	(+) 40,000	(-) 30,000

Required :

Prepare Comparative Income Statement, for the first two years of operations, using *both* Absorption Costing and Marginal Costing. Also prepare a statement reconciling the difference in profit, if any, between the two methods.

Solution. *Under Absorption Costing Method*

	Year 1	Year 2
Production (Units)	2,20,000	1,70,000
Units Sold	1,80,000	2,00,000
Sales @ Rs. 25 per unit	Rs. 45,00,000	Rs. 50,00,000
Opening Stock	-	5,60,000
Cost of Production		
Direct Material @ Rs. 4	Rs. 8,80,000	6,80,000
" Labour @ Rs. 5	8,80,000	6,80,000
" V. Mfg. O.H. @ Rs. 2	4,40,000	3,40,000
Fixed O.H. @ Rs. 4	8,80,000	6,80,000
Total	30,80,000	29,40,000
Less Closing stock 40,000 × Rs. 14 10,000 × Rs. 14	5,60,000	1,40,000
Cost of Sales (actual)	25,20,000	28,00,000
Less : Over-absorbed fixed cost 20,000@ × Rs. 4	80,000	
Add : Under-absorbed fixed cost 30,000 × Rs. 4		1,20,000
Adjusted cost of goods sold	24,40,000	29,20,000
Profit	20,60,000	20,80,000

(@ Actual production (2,20,000 units) less standard capacity (2,00,000 units) = 20,000 units)

Under Marginal Costing Method

	Year 1	Year 2
Sales	Rs. 45,00,000	Rs. 50,00,000
Marginal Cost :		
Opening Stock	—	4,00,000
D. Material @ Rs. 4	8,80,000	6,80,000
D. Labour @ Rs. 4	8,80,000	6,80,000
Variable Mfg. O.H. @ Rs. 2.0	4,40,000	3,40,000

Total Production Variable Cost	22,00,000	21,00,000
Less Closing stock	4,00,000	1,00,000
Variable Cost of goods sold	18,00,000	20,00,000
Contribution Margin	27,00,000	30,00,000
Less Fixed Cost	8,00,000	8,00,000
Profit	19,00,000	22,00,000

Reasons for difference in profit shown by two methods :

1. *Year 1*—Absorption Costing shows a profit of Rs. 20,60,000, while Marginal costing shows a profit of Rs. 19,00,000 i.e., difference of Rs. 1,60,000. The reason for this is that fixed cost relating to units representing closing stock, i.e., 40,000 units \times Rs. 4 or Rs. 1,60,000 has not been charged under absorption costing. For this reason, the profit under absorption costing is more than the profit shown by marginal costing by Rs. 1,60,000.
2. *Year 2*—Marginal Costing shows more profit than absorption costing. Profit figure as per marginal costing is Rs. 22,00,000 while profit figure as per absorption costing is Rs. 20,80,000. Closing stock is less than opening stock. For this reason, the fixed cost relating to units produced in year 1 has been charged in Year 2 under absorption costing. The amount of difference can be explained as follows :
 (Opening stock—closing stock) \times Fixed cost per unit or (40,000 units – 10,000 units) \times Rs. 4 = Rs. 1,20,000. The difference between profits under two methods in Year 2 is also Rs. 1,20,000 i.e. Rs. 22,00,000 – Rs. 20,80,000. Profits under absorption costing in Year 2 is less than the profit under marginal costing by this amount.

Problem 214 (Selling at split-off point or after further processing). The Chemco Company purchases Brimco in department 1, where it is split-off into products X, Y and Z. Product X is sold at the split-off point with no further processing. Products Y and Z require further processing to finish them before they can be sold. Product Y is finished in department 2 and Product Z is finished in department 3. The following is a summary of the costs and other related data for the year ending 30th September, 1990 :

	Department		
	1	2	3
Direct Labour	Rs. 28,000	Rs. 90,000	Rs. 1,30,000
Manufacturing Overhead	20,000	42,000	98,000
	<u>48,000</u>	<u>1,32,000</u>	<u>2,28,000</u>
		Products	
	X	Y	Z
Quantity processed (Litres)	60,000	60,000	1,20,000
Quantity on hand on 30-9-90 (Litres)	20,000	0	30,000
Sales (Rs.)	60,000	1,92,000	2,83,500

The cost of BRIMCO purchased during the year was Rs. 1,92,000. There were no inventories on hand on 1st October, 1989, and there was no BRIMCO on hand on 30th September, 1990. All the products on hand at the year-end were complete as to processing, and there were no cost variances.

Required :

- Calculate the total amount of joint costs to allocate among products X, Y and Z on 30th September, 1990.
- Allocate the total joint costs to products X, Y and Z using market measures as on allocation base.
- What is the total cost of product Y sold during the year ?
- Products X could have been processed in department 4 at a total separable cost of Rs. 1.20 per unit. The market price for the finished product X is Rs. 2.50 per unit. Did the management make the right decision to sell product X at the split-off point ?

Solution. (a) *Total amount of joint costs to be allocated among products X, Y and Z*

Cost of Brimco	Rs. 1,92,000
Add : Cost of Department 1	
Direct Labour	Rs. 28,000
Mfg. O.H.	20,000
	<u>48,000</u>
Joint Cost	<u>2,40,000</u>

(b) *Table showing allocation of total joint costs to products X, Y and Z using market measure i.e., market value less cost to complete the individual joint products.*

Products	Production in terms of Sales Value	Less costs beyond split off Point	Approximate relative sale value at split off point	Computation	Joint Cost Assigned
X	Rs. 90,000*	-	Rs. 90,000	(90,000 + 3,00,000) × 2,40,000	Rs. 72,000
Y	1,92,000	Rs. 1,32,000	60,000	(60,000 + 5,00,000) × 2,40,000	
Z	3,78,000@	2,28,000	1,50,000	(1,50,000 + 3,00,000) × 2,40,000	48,000
			<u>3,00,000</u>	<u>1,20,000</u>	<u>2,40,000</u>

*(Rs. 60,000 + 40,000 Ltrs.) × 60,000 Ltrs.; @ (Rs. 2,83,500 + 90,000 Ltrs.) × 1,20,000 Ltrs.

(c) *Total cost of 60,000 Ltrs. of product Y :*

Share of pre-separation cost	= Rs. 48,000
Add Cost incurred in Department 2	= 1,32,000
	<u>1,80,000</u>

(d) Table showing profit per Litre of product X under both alternatives.

Details	Alternative I (Sold at split off point)	Alternative II (Sold after further processing)
Pre-separation cost per litre (Rs. 72,000 ÷ 60,000 Ltrs)	Rs. 1.20	Rs. 1.20
Further processing Cost	—	1.20
Total Cost (A)	1.20	2.40
Selling price per Ltr. (B)	1.50*	2.50
Profit (B-A)	0.30	0.10

Comments—Management took the right decision to sell product X at split-off point, because at that point profit per Ltr. was Re. 0.30 against the profit of Re 0.10 per Ltr. after further processing.

Problem 215 (Manufacturing vs. Sub-contracting—Special key factor situation). HAZY Ltd. manufactures for products—P, Q, R and S. The direct costs of production are estimated at :

	P	Q	R	S
Materials	Rs. 36	Rs. 38	Rs. 42	Rs. 24
Labour :—				
Assembly (at Rs. 4 per hour)	8	12	16	16
Machinists (at Rs. 6 per hour)	12	24	18	36

Total fixed cost are dependent on output levels, as follows :

Production (Units)	Total Fixed Costs
Upto 50,000	Rs. 4,00,000
50,001 to 75,000	5,00,000
75,001 to 1,00,000	6,00,000

The Sales Director estimates that demand for their products in the next year will be as follows :

	P	Q	R	S
Units	18,000	30,000	27,000	15,000
Selling price per unit (Rs.)	68	90	91	94

The production manager states that the capacity of existing machines is 2,10,000 hours per annum, though this will be increased to 3,00,000 hours in two years' time when new plant which is currently on order will be delivered. Meanwhile, a local firm has offered to manufacture any of the products on a sub-contract basis at the following prices :

P	Rs. 63
Q	Rs. 80
R	Rs. 72
S	Rs. 82

* Rs. 60,000 ÷ 40,000 ltrs. = Rs. 1.50 per ltr.

Required :

- Advise the management to what extent the services of the sub-contractor should be utilised in order to meet the expected demand of P, Q, R and S.
- Prepare a statement showing the profit you would expect if your advice is followed.
- Discuss briefly the reasoning you have applied in making your recommendation.

Solution.*Workings :*

Statement showing the contribution per if products are manufactured

	P	Q	R	S
Sales Price (Rs.)	68	90	91	94
Variable Cost :				
Material	36	38	42	24
Labour :				
Assembly (at Rs. 4 per hour)	8	12	16	16
Machinists (at Rs. 6 per hour)	12	24	18	36
Total Variable Cost	56	74	76	76
Contribution	12	16	15	18
Hours per unit (Machinist)	2 hrs.	4 hrs.	3 hrs.	6 hrs.
Contribution per hour (A)	6	4	5	3
Ranking if only contribution per hour is considered	I	III	II	IV

Statement showing margin per unit if sub contracting is done.

	P	Q	R	S
Sales	Rs. 68	Rs. 90	Rs. 91	Rs. 94
Sub-contractors' charges per unit	63	80	72	82
Net Margin per unit	5	10	19	12
Machinists hours per unit	2	4	3	6
Net Margin per hour (B)	Rs. 2.50	2.50	6.33	2.00
Decision whether to manufacture or sub-contract based on comparison of (A) and (B)	P should be manufactured	Q should be manufactured	R should be manufactured	S should be manufactured

Factors for Optimum Plan : It is clear from the above that R should *not* be manufactured and as such it should be entirely sub-contracted. In case of products P, Q and S, manufacturing is better than sub-contracting. Therefore first emphasis should be on manufacturing based on ranking and then, if capacity permits, sub-contracting should be resorted to.

Optimum Plan :

Manufacturing : 2,10,000 hours of machinists should be utilized as follows :

Products	Rank	Units	Hours per unit	Hours utilized	Balance hours
P	I	18,000	2	36,000	1,74,000
Q	III*	30,000	4	1,20,000	54,000
S	IV	9,000@	6	54,000	—

Sub contracting :

S (Balance) 6,000 units

R 27,000 units

(a) The services of the sub-contractor should be utilized as under :

27,000 units of R

6,000 units of S

(b) *Statement showing the profit for following the optimum plan profit by manufacturing.*

Products	Units	Contribution per unit	Total contribution
P	18,000 ×	12	= Rs. 2,16,000
Q	30,000 ×	16	= 4,80,000
S	9,000 ×	18	= 1,62,000
	<u>57,000</u>		<u>8,58,000</u>
Less : Fixed Cost for 50,001 to 75,000 units			<u>5,00,000</u>
			<u>3,58,000</u>

Add : Profit by Contracting :

Rs. 27,000 units × Rs. 19 = Rs. 5,13,000

S 6,000 units × 12 = 72,000 5,85,000

Net profit 9,43,000

Note : The optimum plan gives a profit of Rs. 9,43,000. By adopting any permutation and combination, the resultant profit will obviously be less than the above profit figure.

(c) R is in making maximum contribution per unit of key factor (machinists hours). Still R should not be manufactured. If R is manufactured, it will give a contribution of 27,000 units × 3 hrs. × Rs. 5 or Rs. 4,05,000. By sub-contracting it is giving a profit margin of 27,000 units × Rs. 19 = Rs. 5,13,000. In this situation, first choice is between manufacturing and sub-contracting and 2,10,000 hours should be utilized for manufacturing only those products, in which manufacturing promises better results than sub-contracting i.e., P, and S.

* R is IInd in ranking, but it should not be produced because in case of R sub-contracting is better than manufacturing.

@ 54,000 hrs ÷ 6 hrs. = 9,000 units.

Problem 216 (Capital Budgeting—Opportunity Cost consideration). EMGEE Ltd. is considering the manufacture of a new product which would involve the use of both a new machine (costing Rs. 1,50,000) and an existing machine, which cost Rs. 80,000, two years ago but has a current net book value of Rs. 60,000. There is *sufficient capacity* on this machine which has so far been under-utilised.

Annual sales of the product will be 5,000 units selling at Rs 32 per unit. Unit cost will be as follows :

Direct Material	Rs. 7
Direct Labour (4 hours at Rs. 2)	8
Fixed Costs, including depreciation	9
	<u>24</u>

The project would have a 5-year life, after which the new machine would have a net residual value of Rs 10,000. Because direct labour is continually in short supply, labour resource would have to be diverted from other work, which currently earns a contribution of Rs. 1.50 per direct labour hour. The fixed overhead absorption rate would be Rs. 2.25 per hour (Rs. 9 per unit), but the actual expenditure on fixed overhead would not alter.

Working capital requirements would be Rs. 10,000 in the first year, rising to Rs. 15,000 in the second year. and remaining at this level until the end of the project when it will all be recovered.

The company's cost capital is 20%. Ignore taxation

Is the project worthwhile ?

Solution.

Statement showing net present value of the project

Year	Initial Cash outflow (Rs)	Cash inflow due to Sales of the product (Rs) Note 2	Cash Inflow at the end of the projec.	Net cash inflow (+) or Cash Outflow (-)	P V factor	N V P
0	{ (1,50,000) (10,000) }	—	—	(1,60,000)	1.000	(1,60,000)
1	(5,000 Refer to Note 5	38,000	—	33 000	0.833	27,489
2	—	38,000	—	38,000	0.694	26,372
3	—	38,000	—	38,000	0.579	22,002
4	—	38,000	—	38,000	0.482	18,316
5	—	38,000	10,000 (Note 3) 15,000 (Note 4)	63,000	0.402	25,326
						<u>(40,495)</u>

Conclusion : —Since the net present value of the project is negative. The project is not worthwhile.

Note 1 —Net Cash inflow (+) and cash outflow (–) due to sales (Rs.)

Year	Sales @ Rs. 32 per unit	D. Material @ Rs. 7 per unit	D. Labour @ Rs. 8 per unit	Opportunity Cost @ Rs. 6 per unit (Note 6)	Fixed Cost (Refer to note 3)	Net Cash flow due to sale (Rs.)
0	—	—	—			
1	1,60,000	(35,000)	(40,000)	(30,000)	(17,000)	38,000
2	1,60,000	(35,000)	(40,000)	(30,000)	(17,000)	38,000
3	1,60,000	(35,000)	(40,000)	(30,000)	(17,000)	38,000
4	1,60,000	(35,000)	(40,000)	(30,000)	(17,000)	38,000
5	1,60,000	(35,000)	(40,000)	(30,000)	(17,000)	38,000

Note 2—Yearly cash flow due to fixed cost

Depreciation on new machine : (Rs. 1,50,000 – Rs. 10,000) ÷ 5 = Rs. 28,000

Annual Fixed Cost including depreciation 9 × 5000 units = Rs. 45,000

Less Fixed Cost 28,000

Annual Cash flow due to fixed cost 17,000

NB : Depreciation has been calculated only on new machine. It is presumed that depreciation on old machine, which has spare capacity, is being charged already and there is no need here to charge depreciation on the machine, which is already in use before.

Note 3—This is residual life of new machine

Note 4—All working capital is recovered at the end of the period.

Note 5—Working capital level in 2nd year rises by Rs. 5,000.

Note 6—Opportunity cost per unit = Rs. 1.50 × 4 = Rs. 6.00

I.C.W.A. Final December 1990

(For Question on Make or Buy Decision having constraint of machine capacity, please refer to Problem A-95.)

Problem 217. (Transfer Pricing—Alternative use of Production Facilities) A company is organised into two large divisions. Division A produces a component which is used by division B in making a final product. The final product is sold for Rs. 400 each. Division A has a capacity to produce 2,000 units and the entire quantity can be purchased by division B.

Division A informed that due to installation of new machines, its depreciation cost had gone up and hence wanted to increase the price of the component to be supplied to Division B to Rs. 220. Division B, however, can buy the component from the outside market at Rs. 200 each. The variable costs of Division A is Rs. 190 and fixed costs Rs. 20 per component. The variable costs of Division B in manufacturing the final product by using the component is Rs. 150 (excluding the component cost).

Present statements indicating the position of each Division and the company as a whole taking each of the following situations separately :

(i) If there are no alternative uses for the production facilities of A, will the company benefit if Division B buys from outside supplies at Rs. 200 per component ?

(ii) If internal facilities of A are not otherwise idle and the alternative use of the facilities will give an annual cash operating saving of Rs. 30,000 to Division A, should Division B purchase the component from outside suppliers ?

(iii) If there are no alternative uses for the production facilities of Division A and the selling price for the component in the outside market drops by Rs. 15, should Division B purchase from outside suppliers ?

(iv) What transfer price would you fix for the component in each of the above three circumstances ?

Solution. (i) Contribution if Division B purchases the component from outside

Division B

Sales (2000 × Rs. 400)	Rs. 8,00,000
------------------------	--------------

Variable Cost :

Purchase cost 2000 × 200	Rs. 4,00,000	
Division B 2000 × 150	3,00,000	7,00,000
Contribution		<u>1,00,000</u>

Company's contribution as a whole will be Rs. 1,00,000

Contribution, if B purchases the component from A.

Contribution by A Division :

Sales (2000 × Rs. 220)	Rs. 4,40,000
Less : Variable cost (2000 × Rs. 190)	<u>3,80,000</u>
	<u>60,000</u>

Contribution by B Division

Sales (2000 × Rs. 400)		Rs. 8,00,000
Less: Variable cost—From Div. A	Rs. 4,40,000	
—own (2000 × 150)	<u>3,00,000</u>	<u>7,40,000</u>
		<u>60,000</u>

Total contribution of company as a whole

$$= \text{Rs. } 60,000 + \text{Rs. } 60,000 =$$

Rs. 1,20,000.

(ii) Contribution from alternative use of facilities

Rs. 30,000

Contribution by B Company

Sales (2000 × Rs. 400)	Rs. 8,00,000
------------------------	--------------

Less Variable cost :

Purchase cost = (2,000 × 200)	4,00,000
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Division B's cost (2000 × 150)	<u>3,00,000</u>
--------------------------------	-----------------

Contribution by Division B

1,00,000

Contribution by the company will be :

$$\text{Rs. } 1,00,000 + \text{Rs. } 30,000 =$$

Rs. 1,30,000

(iii) If purchased from outside

Division B

Sales (2000 × Rs. 400)	Rs. 8,00,000
------------------------	--------------

Less : Variable Cost :

Purchase cost (2000 × 186)	3,70,000
----------------------------	----------

Variable cost of Div. B (200 × 150)	<u>3,00,000</u>
-------------------------------------	-----------------

Contribution of Division B

1,30,000

Contribution of A Division

Nil

Contribution of company as a whole

Rs. 1,30,000

If purchased from Division A

Division B

Sales (2000 × Rs. 400)	Rs. 8,00,000
------------------------	--------------

Less : Variable Cost

Purchase cost 2000 × 220	4,40,000
--------------------------	----------

B's Variable Cost 2000 × 150	<u>3,00,000</u>
------------------------------	-----------------

Contribution of B Division

60,000

Division A :

Sales (2000 × Rs. 220)	= 4,40,000
Less : Variable cost (2000 × 190)	3,80,000
Contribution of Division A	<u>60,000</u>

Total contribution of company as a whole = Rs. 60,000 + 60,000 = Rs. 1,20,000

(iv) (a) For situation 1, if alternative use of facilities is not available, then transfer price should be Rs. 190

(b) If its facilities can be alternatively used, then the price will be :

Variable Cost	Rs. 190
Opportunity Cost (Rs. 30,000 ÷ 2,000)	15
Total transfer price	<u>205</u>

(c) If market price is reduced to Rs. 185, and alternative use of facilities are not available, transfer price should be Rs. 190. Then no external market exists for intermediate product, transfer should occur at incremental cost of production which in this case is Rs. 190

(For Question on Joint Products, please refer to Problem 8.9.)

Problems 218. (Cost Sheet—Use of scrap and spoilage concepts) A company manufactures a specialised product. The production department receives two types of raw materials, performs a number of operations on them and transfers the finished goods to the warehouse. Certain amount of spoilage takes place in the process of manufacture.

Each unit of output requires 1.5 kg of raw material A at Rs. 40 per kg and 0.5 kg of raw material B at Rs. 80 per kg. Scrap in respect of raw material A works out to 5% of input. Scrap to the extent of 2% of input is lost and 3% is collected and auctioned at Rs. 2 per kg. In the case of raw material B, spoilage works out to 20% of the finished product and 4% of the spoiled units of each batch can be salvaged and sold as scrap at Rs. 10 per spoiled unit.

The manufacturing department employs 15 men who work 8 hours per day for 25 days in a month. In each shift of 8 hours a worker on an average loses 10% of his time as normal idle time and spends 30 minutes on break and 12 minutes on receiving instructions from the supervisor. Further each worker also spends 40 minutes on an average in a shift on re-work operations of the product. A worker on an average can produce 20 units of finished output in an uninterrupted time frame of 70 minutes. The comprehensive average wage rate is Rs. 6 per hour.

The company has prepared the following budget of overhead expenses for two levels of output :

<i>Output budget</i>	<i>50,000 units</i>	<i>40,000 units</i>
Supervision	Rs. 4,740	Rs. 4,740
Indirect Labour	20,000	18,000
Paint Materials	60,000	48,000
Consumable Stores	10,000	8,000
Repairs and Maintenance	25,000	21,000
Power	5,000	4,200
Fuel	16,000	14,000
Depreciation	14,000	14,000
Other Overheads	49,635	49,635

The production is carried out in batches of 1,000 units. The company desires a profit of 20% on selling price. Prepare a cost sheet and determine the selling price per unit.

Solution*Batch 1,000 units***Cost Sheet***Direct material*

A—1.5 kg × 1000 × 1.05 × Rs. 40 = Rs. 63,000

B—0.5 kg × 1000 × 1.20 × Rs. 80 = 48,000

Total 1,11,000

Less: Scrap

A (Refer to Note 1) Rs. 90.00

B (Refer to Note 2) 80.00 170 1,10,830

Direct Labour (Refer to Note 3)

(18,000 + 37,500) × 1,000 480

Overhead (Refer to Note 4)

(1,75,875 + 37,500) × 1000 4,690

Total Costs 1,16,000

Profit 20% of selling price or 25% of cost 29,000

1,45,000

Price per batch = Rs. 1,45,000 ÷ 1000 = Rs. 145

*Note 1.**Material A — Scrap (Based on Input)*

Gross Consumption — 1.5 × 1000 × 1.05 Rs. 1,575

Net Consumption — 1.5 × 1000 = 1,500

Scrap (5% of Input) 75

Realization from scrap (3% of input) = $\frac{75}{5} \times \frac{3}{1} \times \text{Rs. } 2 = \text{Rs. } 90.00$

Note 2**Material B — Spoilage (Based on finished output)**

$$\left(1 \text{ units} \times \frac{20}{100} \times 1,000\right) \times \frac{4}{100} \times \text{Rs. } 10 = \text{Rs. } 80$$

Note 3

Direct labour hours (8 hrs. × 60)		480 minutes
Normal Idle Time	=	48 hrs.
Break	=	30 "
Instruction	=	12 "
Rework	=	40 "
		<u>130 minutes</u>
		<u>350</u>

Total minutes in a month = 15 men × 25 days × 350 hrs. = 131250 minutes

Production in a month = (20 + 70) × 131250 = 37,500 units

Note 4. Table showing overhead at different levels

Items	Overhead		Nature	V. Cost per unit	Fixed component	OH (F+V) for 37,500 units
	at 50,000 units	at 40,000 units				
Supervision	Rs. 4,740	Rs. 4,740	F	—	Rs. 4,740	4,740
Indirect Labour	20,000	18,000	SV	0.2	10,000	17,500
Plant Materials	60,000	48,000	V	1.2	—	45,000
Consumable stores	10,000	8,000	V	0.2	—	7,500
Repairs & Maintenance	25,000	21,000	SV	0.4	5,000	20,000
Power	5,000	4,200	SV	0.08	1,000	4,000
Fuel	16,000	14,000	SV	0.2	6,000	13,500
Depreciation	14,000	14,000	F	—	14,000	14,000
Other Overhead	49,635	49,635	F	—	49,635	49,635
						<u>1,75,875</u>

Problem 219. (Operating Statement Reconciliation of Budgeted and Actual Profits) A single product company has furnished the following standard cost data per unit of output.

Direct Materials	20 kg at Rs. 10 per kg
Direct Labour	12 hours at Rs. 5.50 per hour
Variable overheads	12 Hours at Rs. 1.00 per hour
Fixed overheads	Rs. 9,00,000 per month based on a normal volume of 60,000 direct labour hours
Selling price	Rs. 600 per unit

The costs incurred and other relevant information for the month of November 1990 are as under :

Direct materials used	1,00,000 kg at a cost of Rs. 10,50,000
Direct wages paid	Rs. 3,10,000 for 62,000 hours worked
Overheads	Rs. 15,26,000 out of which a sum of Rs. 9,40,000 is fixed
Actual output	4,80,000 units sold for Rs. 28,32,000

Assume no stocks of work in process or finished goods at the beginning or the end of the month.

Required:

- (i) Compute all variances.
- (ii) Prepare an operating statement reconciling the budgeted profit and actual profit.

Solution.

(i) For Material Cost Variances

M ₁ — Actual cost of material used (Given)	Rs. 10,50,000
M ₂ — Standard cost of material used (1,00,000 kg × Rs. 10)	10,00,000
M ₃ — Not Applicable	—
M ₄ — Standard material cost of units sold 4800 units × 20 kg × Rs. 10	9,60,000

$$\text{Material Price Variance} = M_1 - M_2 = \text{Rs. } 10,50,000 - \text{Rs. } 10,00,000 \\ = \text{Rs. } 50,000 \text{ (A)}$$

$$\text{Material Usage Variance} = M_2 - M_4 = \text{Rs. } 10,00,000 - \text{Rs. } 9,60,000 \\ = \text{Rs. } 40,000 \text{ (A)}$$

For Direct Wage Variances

L ₁ — Actual payment made to workers for actual hours worked	Rs. 3,10,000
L ₂ — Actual payment if workers had been paid at standard rate (62,000 hrs. × Rs. 5.50)	Rs. 3,41,000
L ₃ — Not Applicable	
L ₄ — Not Applicable	
L ₅ — Standard labour cost of output achieved (4,800 units × 12 hrs × Rs. 5.50)	Rs. 3,16,800

$$\text{Wage Rate Variance} = L_1 - L_2 = \text{Rs. } 3,10,000 - \text{Rs. } 3,41,000 = \text{Rs. } 31,000 \text{ (F)}$$

$$\text{Wage Efficiency Variance} = L_2 - L_5 = \text{Rs. } 3,41,000 - \text{Rs. } 3,16,800 = 24,200 \text{ (A)}$$

For Variable Overhead Variances

VO ₁ —Actual variable overhead incurred	Rs. 5,86,000
VO ₂ —Actual hrs. worked at std. variable overhead rate (62,000 hrs × Rs. 10)	Rs. 6,20,000
VO ₃ —Standard variable overhead (4,800 units × 12 × Rs. 10)	Rs. 5,76,000

$$\text{Variable Overhead Expenditure Variance} = VO_1 - VO_2 \\ \text{Rs. } 5,86,000 - \text{Rs. } 6,20,000 = \text{Rs. } 34,000 \text{ (F)}$$

$$\text{Variable Overhead Efficiency Variance} = VO_2 - VO_3 \\ = \text{Rs. } 6,20,000 - \text{Rs. } 5,76,000 = \text{Rs. } 44,000 \text{ (A)}$$

For Fixed Overhead Variances

FO ₁ —Actual fixed overhead incurred	Rs. 9,40,000
FO ₂ —Budgeted fixed overhead	Rs. 9,00,000
FO ₃ —Fixed overhead for hours/days available (No Calendar variance)	Nil

FO ₄ —Fixed Overhead for hours worked at standard fixed overhead rate	
62,000 hrs × Rs. 15	Rs. 9,30,000
FO ₅ —Standard fixed overhead for production	
4,800 units (Rs. 9,00,000 + 60,000) × 12	Rs. 8,64,000
Fixed Overhead Expenditure Variance = FO ₁ - FO ₂	
= Rs. 9,40,000 - Rs. 9,00,000	Rs. 40,000 (A)
Fixed Overhead Capacity variance = FO ₂ - FO ₄	
= Rs. 9,30,000 - Rs. 9,00,000	Rs. 30,000 (F)
Fixed Overhead Efficiency Variance FO ₄ - FO ₅	
= Rs. 9,30,000 - 8,64,000	= Rs. 66,000(A)

Actual Selling Price per unit = Rs. 28,32,000 ÷ 4800 = Rs. 590

For Sales Margin Variance

Actual Selling Price

Per unit

Rs. 590

Less : Standard Cost

566

Actual Sales Margin

24

SM₁ — Actual Sales Margin on actual sales 4,800 × Rs. 24 Rs. 1,15,200

SM — Actual Sales Margin on actual Sales

4800 × (Rs. 600 - Rs. 566)

1,63,200

SM₃ — No Sales Margin Mix Variance

SM₄ — Budget Sales Margin as per budget :

(Budgeted Production = 60,000 hrs + 12 hrs = 5000 units)

5,000 units (Rs. 600 - Rs. 566)

1,70,000

Sales Margin Price Variance = SM₁ - SM₂

= Rs. 1,15,200 - Rs. 1,63,200

Rs. 48,000 (A)

Sales Margin Volume Variance = SM₂ - SM₄

= Rs. 1,63,200 - Rs. 1,70,000

Rs. 6,800 (A)

(ii) Reconciliation

Budgeted Profit 5000 units × (Rs. 600 - Rs. 566)

Rs. 1,70,000

Adjustment of Variances

(F)

(A)

Sales Margin Price Variance

Rs. 48,000

Sales Margin Volume Variance

6,800

Material Price Variance

50,000

Material usage Variance

40,000

Direct Wage Rate Variance

Rs. 31,000

Direct Wage Efficiency Variance Expenditure

24,200

Variable Overhead Variance

34,000

Variable Overhead Efficiency Variance

44,000

Fixed Overhead Exp. Variance

40,000

Actual Loss

40,000

Fixed Overhead Capacity Variance

Rs. 30,000

Variable Overhead Efficiency Variance

66,000

Total

95,000

3,19,000

2,24,000 (A)

Rs. 54,000

(For Question on "Profitability of two machines", please refer to Problem A-100)

Problem 220. (Product-Mix Key Factor) A company produces three products. The General Manager has prepared the following draft budget for the next year.

	Products		
	A	B	C
No. of units	30,000	20,000	40,000
Selling Price (Rs./unit)	40	80	20
P/V Ratio	20%	40%	10%
Raw material cost as percentage to sales value	40%	35%	45%
Maximum sales potential (units)	40,000	30,000	50,000

The company uses the same raw material in all the three products and the price per kg of the raw material is Rs. 2.

The company envisages a profit of 10% on the budgeted turnover before interest and depreciation which are fixed. Interest and depreciation are estimated at Rs. 3,00,000 and Rs. 10,00,000 respectively. The draft budget makes full utilisation of the available raw material which is in short supply.

The Managing Director is not satisfied with the budgeted profitability and hence he has passed on the aforesaid draft budget to you for review. *

Required :

- Set an optimal product mix for the next year and find its profit.
- The company has been able to locate a source for the purchase of an additional 20,000 kgs. of raw materials at an enhanced price. The transport cost of this additional quantity of raw material is Rs. 10,000. What is the maximum price per kg that can be offered by the company for the additional quantity of raw material.

Solution (a)

Details	A	B	C
	Rs.	Rs.	Rs.
(i) Sales	12,00,000	16,00,000	8,00,000
(ii) P/V ratio	20%	40%	10%
(iii) Contribution	2,40,000	6,40,000	80,000
(iv) No. of Units	30,000	20,000	40,000
(v) Contribution per unit	Rs. 8	Rs. 32	Rs. 2
(vi) Selling Price (Rs./unit)	40	80	20
(vii) Raw material cost as percentage to sales value	40%	35%	40%
(viii) Raw material cost per unit	Rs. 16	Rs. 28	9
Relate (vi) and (vii)			
(ix) Consumption of material per units in Kg. (Price Rs. 2 per kg)	8 kg	14 kg	4.5 kg
(xi) Contribution per kg [(v) ÷ (ix)]	Rs. 1.00	Rs. 2.28	Rs. 0.44
(xii) Ranking based on contribution per kg.	II	I	III

Total material, for which optimum utilization is to be attempted based on key factor consideration.

Products	No. of Units Produced	Consumption per unit (kg)	Total consumption (kg)
A	30,000	8	2,40,000
B	20,000	14	2,80,000
C	40,000	45	1,80,000
			<u>7,00,000</u>

(i) Optimal product mix for next year

Product	Maximum Number	Proposed units	Consumption per unit (kg)	Material		Contribution	
				Used (kg)	Balance (kg)	Per kg Rs	Total
B	30,000	30,000	14	4,20,000	2,80,000	32 + 14	9,60,000
A	40,000	35,000	8	2,80,000	—	Rs 1	2,80,000
Total contribution							12,40,000
Less Fixed cost (Refer to note at the end)							10,00,000
Profit by optimal mix							<u>2,40,000</u>

Note - Turnover = Rs. 36,00,000

Profit before interest & depreciation 10% of Rs. 36 lacs = Rs. 3,60,000

Less : interest & depreciation 4,00,000

Loss 40,000

We know that

$$\text{Sales} - \text{Variable Cost} = \text{Fixed cost} + \text{Profit}$$

$$\text{or Contribution} = \text{Fixed cost} + \text{Profit}$$

$$\text{or Contribution} = \text{Fixed cost} - \text{Loss}$$

$$\text{or Contribution} + \text{Loss} = \text{Fixed cost}$$

$$\text{Fixed cost} = \text{Rs } 9,60,000 + \text{Rs } 40,000 = \text{Rs } 10,00,000$$

$$(ii) \text{ Raw Material Cost of A} \quad \text{Rs. 16}$$

$$\text{Price per kg.} \quad \text{Rs. 2}$$

$$\text{Raw material consumed per unit of A} = 16 \div 2 = 8 \text{ kg}$$

$$\text{Additional Quantity Available} = 20,000 \text{ kg}$$

$$\therefore \text{ Additional units A to be produced} = 20,000 \text{ kg} \div 8 = 2,500 \text{ units}$$

Since only 35,000 units are produced by optimum plan proposed in (i) and maximum production limit by product A is 40,000 units, company can purchase this additional quantity of raw material for production of product A.

$$\text{Additional contribution per unit of A} = \text{Rs. 8}$$

$$\text{Additional contribution will be } 2,500 \text{ units} \times \text{Rs. 8} \quad \text{Rs. 20,000}$$

$$\text{Less : Transport cost} \quad \text{10,000}$$

$$\text{Balance available for price increase} \quad \text{10,000}$$

$$\text{Maximum additional price} = 10,000 \div 20,000 = \text{Rs. 0.50 per kg}$$

$$\text{or Maximum price} = \text{Rs. 2.00} + 0.50 = \text{Rs. 2.50 per kg}$$

Problem 221. (Probability Application :- Market Research Study). Toys for Tiny Tots Ltd. manufactures high-quality toys for children, which are sold by mail order and through departmental stores.

Kiddy Products is prepared to sell the design and manufacturing rights for three products. However it will only sell the rights to one product, not two or three. The costs of the rights are :

Pussy Cat	Rs. 62,500
Teddy Bear	75,000
Jack in Box	52,500

Toys for Tiny Tots Ltd. feel that any of these products would make an attractive addition to its range, though the products would have a sales life of only one year and wish to select the best of the three products. The following information has been made available :

	<i>Pussy Cat</i>	<i>Teddy Bear</i>	<i>Jack in Box</i>
Selling Price per unit	Rs. 199	140	115
Variable Cost per unit	98	75	65
Fixed Production Costs	70,000	95,000	60,000
Advertising	55,000	40,000	20,000

These figures have been worked out with great care and circumspection. But when it comes to sales volumes, the Sales Manager could provide only the following analysis of possibilities :

<i>Pussy Cat</i>		<i>Teddy Bear</i>		<i>Jack in Box</i>	
<i>Volume (units)</i>	<i>Probability</i>	<i>Volume (units)</i>	<i>Probability</i>	<i>Volume (units)</i>	<i>Probability</i>
2,000	0.7	Nil	0.1	2,500	0.1
3,000	0.2	3,000	0.4	3,000	0.3
4,000	0.1	6,000	0.5	4,000	0.4
—	—	—	—	5,000	0.2

You are required to :

(a) advise the Company of the best course of action based on the above information.

(b) in the case of Teddy Bear it is felt that the Company should launch a market research study costing Rs. 20,000 which would be able to determine precisely whether the sales would be nil, 3,000 or 6,000 units. Is it worthwhile to undertake the study ? Assume all costs are avoidable. 20

Solution : *Statement showing the expected sales and expected profits from different toys.*

<i>Pussy cat</i>			<i>Teddy Bear</i>			<i>Jack in Box</i>		
<i>Volume (units)</i>	<i>Proba- bility</i>	<i>Expected sales</i>	<i>Volume (units)</i>	<i>Proba- bility</i>	<i>Expected sales</i>	<i>Volume (units)</i>	<i>Proba- bility</i>	<i>Expected sales</i>
2,000	0.7	1,400	Nil	0.1	—	2,500	0.1	250
3,000	0.2	600	3,000	0.4	1,200	3,000	0.3	900
4,000	0.1	400	6,000	0.5	3,000	4,000	0.4	1,600
—	—	—	—	—	—	5,000	0.2	1,000
1.Expected Sales		2,400			4,200			3,750

2. Contribution per unit (Rs.) 101	65	50
3. Total Contribution (1 × 2)	2,42,400	
	2,73,000	1,87,500
4. Less Period Costs		
a) Cost of the rights 62,500	75,000	52,500
b) Fixed production costs 70,000	95,000	60,000
c) Advertising 55,000	40,000	20,000
Total 1,87,500	2,10,000	1,32,500
5. Expected Profit (3 - 4)	54,900	55,000
	63,000	

Expected profit of Teddy Bear is the highest (Rs., 63,000) and as such rights to manufacture this toys should be acquired. Now find out the expected profit from Teddy Bear with different sales levels and probability.

Sales volume	Probability	Unit Contribution	Total contribution	Fixed cost	Profit/(Loss)	Expected Profit (6) × (2)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Nil	0.1	65	—	2,10,000	(2,10,000)	(21,000)
3,000	0.4	65	1,95,000	2,10,000	(15,000)	(6,000)
6,000	0.5	65	3,90,000	2,10,000	1,80,000	90,000
						63,000

It is noticed that there is a loss when the sales are between 0 to 3,000 units (combined probability = 0.5). However, if sales are 6,000 units (probability = 0.5), then there will be sufficient profit.

(b) It is given in the question that all costs are assumed to be avoidable. Keeping this in view, it would be worthwhile to spend Rs. 20,000 for conducting market research. The purpose of conducting this research is to determine precisely whether the sale would be nil, 3,000 or 6,000 units. The expected profit of Teddy Bear is Rs. 63,000 (highest). The expected profit on the next best product (Jack in Box) is Rs. 55,000. The cost of market research is Rs. 20,000 less cost avoided (Rs. 6,000) = Cost of being certain (Rs. 14,000). This cost (Rs. 14,000) has to be deducted from expected profit (Rs. 55,000) on Jack in Box. Thus potential loss of Rs. 6,000 is converted into likely profit of Rs. 41,000 (i.e., Rs. 55,000 - Rs. 6,000).

Problem 222. (Capital Budgeting) The Electronic Gadgets Division of Home Appliances Ltd. is considering to make and sell a mini personal computer for household use. The plant to be purchased for this project will cost Rs. 2,40,000. Project analysis done by the Divisional Accountant give the following figures :

Rs. '000'

Year	1	2	3	4
Sales	400	600	800	600
Costs				
Materials :				
Opening Stock	40	80	80	60
Plus : Purchases	200	240	300	180
	240	320	380	240
Less : Closing Stock	80	80	60	—
Cost of material used	160	240	320	240
Labour	80	120	120	80
Production Expenses	80	90	92	100
Depreciation	40	40	40	40
Group Administration allocated	54	76	74	74
Interest	22	22	22	22
	436	588	668	556
Net Profit	(36)	12	132	44

(i) The plant used for this product is highly specialised and is unlikely to have any terminal value after meeting dismantling costs at the end of its four-year working life. However depreciation is based on a six-year life using the straight line method.

(ii) The opening stock has to be purchased before the project starts.

(iii) Production expenses is inclusive of a proportion of fixed factory overheads charged out as 25% of labour costs. The remaining production expenses are all incremental cash costs.

(iv) When the project is commissioned, existing old machinery will become redundant, since the new plant can do the work of the old machinery in its spare time, at a cost saving of Rs. 36,000 per annum. The old machinery which is completely written down for tax purposes, has a book value of Rs. 60,000 but could be sold at once for Rs. 20,000 which will be subject to tax. It would otherwise be sold in four years' time for Rs. 8,000. These cost savings are ignored in the above analysis except that the disposal proceeds have been deducted from the envisaged external incremental borrowings and are reflected in a reduced interest charge.

(v) Home Appliances Ltd. requires a return of 14% on capital projects to equal the cost of capital for the Division.

The Marketing Director has expressed his reservations to the project on the grounds that the calculation excludes :

(i) An advertising campaign to launch the product costing an estimated Rs. 40,000 before production commences, with supplementary expenditure of Rs. 10,000 per annum in the first three years of the project.

(ii) The new product will compete with an electronic calculator, already marketed by the Division and will force a revision of budgeted sales as under :

Year	Original Forecast	Revised Forecast
1	5000 × Rs. 160	5000 × Rs. 150
2	4000 × Rs. 120	3000 × Rs. 100
3	2000 × Rs. 80	—
4	—	—

Production costs are budgeted as :

Year	1	2	3
Variable Costs (Rs.)	120	90	60
Fixed Costs allocated	20	20	20
	140	110	80

(iii) The Marketing Director has his own doubts about 14% as the cost of capital of the Division.

In the light of the above observations and figures supplied, you are required to advise whether the project is viable at 14% as the cost of capital and also comment at what cost of capital the product ceases to be viable. Assume Corporate Tax is 40% for the next five years.

Note : Present Value of Re. 1.

Discount Factor	1	2	3	4	5
14%	0.877	0.770	0.675	0.592	0.519
20%	0.833	0.694	0.579	0.482	0.402

Solution : Discounted Cash Flow appraisal for the production and sale of personal computers.

('000')

Detail	Year					
	0	1	2	3	4	5
Sales	—	400	600	800	600	—
Purchases	—	(200)	(240)	(300)	(180)	—
Labour	—	(80)	(120)	(120)	(80)	—
Production exp. (Refer to Note 1)	—	(60)	(60)	(62)	(80)	—
Advertising	(40)	(10)	(10)	(10)	—	—
Sale of existing machine (Refer to Note 2)	20	36	36	36	28	—
Lost Contribution (Refer to Note 3)	—	(50)	(90)	(40)	—	—
Machinery	(240)	—	—	—	—	—
Stock	(40)	—	—	—	—	—
Net Cash Inflow	(300)	66	116	304	288	—
Corporate Taxation (Refer to Note 4)	—	8	(30.4)	(46.4)	(113.6)	(91.2)
Net Cash Inflow	(300)	28	85.6	257.6	174.4	(91.2)
PV factor 14%	1	0.877	0.770	0.675	0.592	0.519
NPV	(300)	24.556	65.912	173.88	103.24	(47.3328)

NPV is positive Rs. 20,255. Therefore project is viable.

Calculation of NPV, when PV factor is 20%
(Rs. '000')

Details	Year					
	0	1	2	3	4	5
Net Cash Flow	(300)	28	85.6	257.6	174.4	(91.2)
PV factor 20%	1	0.833	0.694	0.579	0.482	0.402
NPV	(300)	23.324	59.4064	149.1504	84.0608	(36.6624)

NPV is negative Rs. 20,720

$$\text{IRR} = 14\% + \left\{ \frac{20255}{(20255 + 20720)} \times 6\% \right\} = 17\%$$

Cost of capital of which product will cease to be viable :

Step (i) $(3 + 14) \times 17 = 3.64$

Step (ii) $3.64 + 17 = 20.64$ or 21%

At 21% cost of capital product will cease to be viable.

Note 1. Production Expenses (actual outflow)

Details	Year			
	1	2	3	4
Other Production exp.	80	90	92	100
Less : Fixed overhead (20% of Labour)	20	30	30	20
Production exp.	60	60	62	80

Note 2.

Details	Sale of Existing Machine				
	0	1	2	3	4
Proceeds	20				
Cost Saving		36	36	36	36
Sale Proceed lost in 4th year				(8)	
	20	36	36	36	28

Note 3 Lost Contribution

Details	Year			
	1	2	3	4
<i>Original forecast</i>				
Sales Price	160	120	80	-
V Cost	120	90	60	—
Contribution per unit	40	30	20	—
Volume	5,000	4,000	2,000	—
Cash Contribution	2,00,000	1,20,000	40,000	—
<i>Revised forecast</i>				
Contribution per unit	30	10	—	—
Volume	5,000	3,000	—	—
Cash contribution	1,50,000	30,000	—	—
Reduction (Rs.)	50,000	90,000	40,000	—

Note 4 Corporate taxation

Before the tax charge can be calculated the net cash flows need adjustment, as it is the cost of material used and not purchased, which is allowable as a deduction for tax purposes.

Details		1	2	3	4	5
Net Cash flow	(300)	36	116	304	288	—
Add Material Purchased	40	200	240	300	180	—
Less Material used		(160)	(240)	(320)	(240)	—
Incremental Profit	(260)	76	116	284	228	—
Tax @40%	—	—	30.4	46.4	113.6	91.2

Problem 223. (Risk Averse, Risk Seeker & Risk Neutral). The Sales Manager of Holders Ltd is considering two new products, only one of which can be added to the firm's product line. Product X is a sure seller. It is certain that 20,000 units of product X (the firm's maximum capacity) can be manufactured and sold each month with a contribution margin of Rs. 5 per unit. Product Y with a contribution margin of Rs. 10 per unit is potentially more profitable. However, there is uncertainty about its marketability and following sales forecast has been prepared.

Sales of Y (units)	Probability
5,000	25
10,000	50
15,000	25

Fixed cost for the months Rs. 60,000

Company invites your comments particularly on Risk neutral, Risk averse and Risk seekers decision makers with necessary calculation.

Solution : If product X is produced

Contribution from product X ($20,000 \times 5$) =	Rs. 1,00,000
Less : Fixed Cost	60,000
Profit	40,000

Expected Value Profit if product Y is produced					
Sales (Units)	Contri- bution (Rs.)	Fixed cost (Rs.)	Profit/ (Loss) (Rs.)	Probabi- lity (Rs.)	Expected value (Rs.)
5,000	50,000	60,000	(10,000)	.25	(2,500)
10,000	1,00,000	60,000	40,000	.50	20,000
15,000	1,50,000	60,000	90,000	.25	22,500
Expected Value of Profit					40,000

Comments :

Risk neutral decision-makers are apt to consider the two products equally desirable because both have E.V. Profit of Rs. 40,000.

Risk averse decision-makers may prefer product X with its guaranteed profit of Rs. 40,000. They will seek to avoid 25% probability of loss of Rs. 10,000.

Risk seekers may prefer product Y. They are likely to be attracted by 20% probability of profit of Rs. 90,000 despite the possibility of a loss of Rs. 10,000. Therefore in this decision, the ultimate decision will depend on each person's decision preference.

Problem 224. (Manual vs. Semi Automatic Production). Soloproducts Ltd. manufactures manually a product under the brand name Distinct. The current variable cost of producing each Distinct is Rs. 4 and the selling price Rs. 10 per unit. The annual fixed costs are Rs. 1,20,000.

There is a proposal to acquire a semi-automatic machine costing Rs. 60,000 to manufacture Distinct. Then the variable cost will decline to Rs. 2 per unit ; but there will be increase in annual cash outlays of Rs. 30,000 and the new annual fixed costs will be Rs. 1,50,000.

The new equipment will have a useful life of 4 years (independent of annual production volume). Soloproducts Ltd. has a cost of capital of 10%. You are required to find out :

(i) What level of annual sales is necessary in order for this investment in semi-automatic machine to break even—that is, generate enough annual profit to repay the initial capital cost and the required rate of return on this capital ?

(ii) What level of annual sales will be necessary to switch over profitably from manual to semi-automatic production ?

Note that the annuity factor representing the present value at an interest rate of 10% of receiving Re. 1 at the end of each of the next 4 years is 3.17.

Ignore Taxation.

Solution. (i) Cost of capital is given as 10%. The life of the semi-automatic machine is 4 years. The annuity factor representing the present value at 10% cost of capital for 4 years is 3.17.

With the purchase of semi-automatic machine variable cost per unit will decline to Rs. 2. Thus the contribution per unit will be : Rs. 10 – Rs. 2 = Rs. 8. The new annual fixed costs will be Rs. 1,50,000. Now we have to find out the annual level of sales. Let the same be assumed as x

$$\text{Profit} = 8x - \text{Rs. } 1,50,000 - (i)$$

But at B.E. point, the profit figure is zero

$$\text{Present Value of (i)} = (8x - \text{Rs. } 1,50,000) \times 3.17$$

$$= 25.36x - \text{Rs. } 4,75,500$$

$$\text{Less Cost of new machine} = (25.36x - 4,75,500) - 60,000$$

$$= 25.36x - 5,35,500$$

$$x = 21,116$$

B.E. Sales = 21,116 or say 21,120 units.

(ii) Annual cost of manual production should be compared with annual cost of semi-automatic production.

$$\text{Annual cost of manual production} = 4x + 1,20,000$$

$$\text{Net present value} = (4x + 1,20,000) \times 3.17$$

$$= 12.68x + 3,80,400 - (i)$$

$$\text{Annual cost of semi-automatic machine } (2x + 1,50,000) \times 3.17$$

$$= 6.34x + 4,75,500$$

$$\text{Add Cost of semi-automatic machine} = 6.34x + 4,75,500 + 60,000$$

$$= 6.34x + 5,35,500 - (ii)$$

$$\text{Equating (i) \& (ii)} \quad 12.68x + 3,80,400 = 6.34x + 5,35,500$$

$$x = 24,464$$

Levels of Sales for switchover = 24,464 units

For Question on investment decision, please refer to problem 15.13.

Problem 225. (Executive Compensation Plan). Happystaff Ltd. have been operating a special incentive scheme for its executives. Every year, the executives receive as special incentives 5 per cent of net income before taxes, interest and incentive payments and after deducting 13% of the average sum of shareholders equity and long term debts for the year. Preparations are afoot for calculating the quantum of incentive payments to executives for the year 1989. In 1988, long term debt (Rs. '000) was Rs. 233.6 and in 1989 it was Rs. 224.2. The 1989 net income before taxes, interest and incentive payments was Rs. 157.3.

The new Finance Director who has joined the company quite recently feels that the executive special incentive scheme is not properly conceived.

As executives are in receipt of a sizable amount each year as incentive, they are complacent and they do not put their best efforts. The profits are mainly due to inflationary conditions and not necessarily to the efficiency shown by the executives. To correct this position, the Finance Director has said that the change in shareholder's equity each year, which mainly consists of retained earnings should be adjusted for changing price levels. For this purpose, he has

developed a GNP deflating factor and has prepared a table with the past ten years figures, extracts from which are given below :

<i>Year</i>	<i>Shareholders' equity</i> Rs.	<i>Changes in Shareholders' equity</i> Rs.	<i>GNP deflator</i>	<i>Adjusted change in equity</i> (1989 Rs.)
1979	188.5	188.5	86.7	359.8
1980	210.7	22.2	91.4	40.2
1981	221.1	10.4	96.0	17.9
*	*	*	*	*
1987	454.8	44.6	141.6	52.1
1988	504.7	49.9	152.1	54.3
1989	590.2	85.5	165.5	85.5
		590.2		868.5

You are required to calculate the quantum of special incentive payments to the executives of Happystaff Ltd. for 1989 by :

- the existing method ;
- using the price level adjusted shareholders' equity data, as prepared by the Finance Director ;
- Comment on the figures. 20

Solution. It is given in this question that every year the executives receives as a special incentive 5% of net income before tax, interest and incentive payments and after deducting 13% of the *average* sum of shareholders equity and long term debts.

(Rs. '000)

Average shareholders equity (1988 & 1989) = $(504.7 + 590.2) \div 2 = 547.45$

Average long-term debt = $(233.6 + 224.2) \div 2 = 228.9$

Average capital employed = Rs. 776.35

Return @13% on capital employed = Rs. $776.35 \times 13\% = \text{Rs. } 100.93$

Net income before interest, taxes and incentive payment = Rs. 157.3

Net income after deducting return = Rs. $157.3 - \text{Rs. } 100.93 = \text{Rs. } 56.37$

Special incentive under existing method @5% = Rs. $56.37 \times 5\% = \text{Rs. } 2.82$

Adjusted Price Level Changes

Adjusted changes in equity have been indicated in the question.

Average adjusted equity = $(868.5 + 783.0) \div 2 = \text{Rs. } 825.75$

Average long-term debt (as above) = Rs. 228.9

Average capital employed (adjusted) = Rs. 1054.65

13% return on average capital employed = Rs. $1054.65 \times 13\% = \text{Rs. } 137.10$

* Rs. $868.5 - 85.5 = 783.0$

Amount of incentive = 5% (Net income before taxes, interest and incentive payments less 13% return on C.E.

$$= 5\% (\text{Rs. } 157.3 - \text{Rs. } 137.10) = \text{Rs. } 1.01$$

Comments : It is indicated that profits are mainly due to inflationary conditions and not necessarily due to the efficiency shown by the executives. Due to inflationary conditions, executives can easily show a reasonable return on investment on equity. It becomes difficult to show such a favourable return on equity once the impact of inflation is removed. Further the rate of 13% return on investment requires revision presuming that such a rate was fixed when inflationary rate was zero.

Note : All figure in the question are in Rs. '000.

Problem 226. (Inflation Accounting) (a) The current cost balance sheet of a company contained the following figures :

	Rs. '000
Current Assets	
Bank and Cash (not included in monetary working capital)	450
Current Liabilities	
Creditors (Hire purchase)	170
Taxation	210
Proposed dividends	250
Bank Overdraft (not included in monetary working capital)	190
Net Assets employed	3,540
Shareholders' funds	2,680
Long-term loans	
Debentures	540
Deferred Liabilities	
Deferred taxation	320

Required : Calculate the current cost gearing proportion.

(b) The facts are exactly the same as (a) above and the current cost adjustments were :

Depreciation	870
Fixed Asset disposals	80
Cost of sales	1,050
Monetary working capital	320

Required : Calculate the current cost gearing adjustment.

Solution : (a) *Current Cost Gearing Proportion.* Gearing proportion is the ratio of Net Borrowing divided by Net Operating Assets. Net Borrowing can be determined as under :

	(Rs. '000)
Debenture	540
Deferred taxation	320
Creditors (for hire purchase)	170

Taxation	210
Bank overdraft	190
Total	1,430
Less : Bank and Cash Balance	450

Net Borrowings	980
-----------------------	------------

Net Operating Assets can be computed as under :

	(Rs. '000)
Shareholders' funds	2,680
Proposed dividends	250
Total Assets	2,930
Add Net Borrowings	980
Net Operating Assets	3,910

Alternatively, Net Operating Assets can be determined as follows :

	(Rs. '000)
Net Capital Employed	3,540
Creditors (for hire purchase)	170
Taxation	210
Bank Overdraft	190
Proposed Dividend	250
Total	4,360
Less : Cash and Bank Balance	450
	3,910

$$\text{Gearing Proportion} = \frac{980}{3,910} \times 100 = 25.1\%$$

(b) Current Cost Gearing Adjustment

	(Rs. '000)
Depreciation	870
Fixed assets disposal	80
COSA	1,050
MWCA	320
	2,320
Gearing Adjustment = 25.1% of 2,320 =	582

C.I.M.A. London November, 1990

Problem 227. Normal/Abnormal Loss or Gain. C Limited manufactures a range of products and the data below refer to one product which goes through one process only. The company operates a thirteen four-weekly reporting system for process and product costs and the data given below relate to Period 10.

There was no opening work-in-progress stock.

5,000 units of materials input at Rs. 2.94 per unit entered the process.

Further direct materials added	13,830
Direct wages incurred	6,555
Production overhead	7,470

Normal loss is 3% of input.

Closing work-in-progress was 800 units but these were incomplete, having reached the following percentages of completion for each of the elements of cost listed.

	%
Direct materials added	75
Direct wages	50
Production overhead	25

270 units were scrapped after a quality control check when the units were at the following degrees of completion :

	%
Direct materials added	$66\frac{2}{3}$
Direct wages	$33\frac{1}{3}$
Production overhead	$16\frac{2}{3}$

Units scrapped, regardless of the degree of completion, are sold for Re. 1 each and it is company policy to credit the process account with the scrap value of normal loss units.

You are required to prepare the Period 10 accounts for the : (i) process account; and (ii) abnormal gain or loss.

Solution.

Process Account

Particulars	Units	Amount	Particulars	Units	Amount
		Rs.			Rs.
To Units introduced	5,000	14,700	By Normal loss @ Re. 1	150	150
To Direct material		13,830	" Abnormal loss*	120	696
" Direct wages		6,555	" Finished production*	3,930	36,349
" Production overhead		7,470	" Closing WIP*	800	5,160
	5,000	42,555		5,000	42,555
To Process A/c		696	By Scrap (120 × Re. 1)		120
		696	" P & L Account		576
					696

*See working notes

Working Notes :

This is a peculiar question of normal/abnormal loss involving use of equivalent concept. For valuation of abnormal loss, finished production and WIP, first of all equivalent units for them will have to be found out as under :

Statement showing Equivalent Units

Particulars	Input	Materials		Direct Wages		P. Overheads	
		%	Units	%	Units	%	Units
Abnormal loss	120	66.67	80	33.33	40	16.67	20
F. Production	3,930	100	3,930	100	3,930	100	3,930
Cl. WIP	800	75	600	50	400	25	200
Total	4,850		4,610		4,370		4,150

Statement of Cost per equivalent unit for each element

Particulars	Cost	Equivalent units	Cost per unit
	Rs.		Rs.
Input material	14,700		
Less: Scrap realisation	150		
	14,550	4,850	3.00
Materials added	13,830	4,610	3.00
Direct wages	6,555	4,370	1.50
Production overhead	7,470	4,150	1.80

Statement showing cost of Abnormal Loss, Finished production and WIP

Particulars	Cost per unit	Eqv. units	Total cost
Abnormal Loss			
Input	Rs. 120	3.00	Rs. 360
Material added	80	3.00	240
D. Wages	40	1.50	60
P. Overheads	20	1.80	36
			696
Finished Production			
Input	3,930	3.00	11,790
Material added	3,930	3.00	11,790
D. Wages	3,930	1.50	5,895
P. Overhead	3,930	1.80	7,074
			36,549
Cl. W.I.P.			
Input	800	3.00	2,400
Material added	600	3.00	1,800
D. Wages	400	1.50	600
P. Overheads	200	1.80	360
			5,160

Problem 228. (Functional Budgets). There is a continuing demand for three sub-assemblies—A, B, and C—made and sold by MW Limited. Sales are in the ratios A 1, B 2, C 4 and selling prices are A Rs. 215, B Rs. 250, C Rs. 300. Each sub-assembly consists of a copper frame onto which are fixed the same components but in differing quantities as follows :

<i>Sub-assembly</i>	<i>Frame</i>	<i>Component D</i>	<i>Component E</i>	<i>Component F</i>
<i>A</i>	1	5	1	4
<i>B</i>	1	1	7	5
<i>C</i>	1	3	5	1
Buying in cost, per unit Rs. 20		Rs. 8	Rs. 5	Rs. 3

Operation times by labour for each sub-assembly are :

<i>Sub-assembly</i>	<i>Skilled hours</i>	<i>Unskilled hours</i>
<i>A</i>	2	2
<i>B</i>	1-1/2	2
<i>C</i>	1-1/2	3

The skilled labour is paid Rs. 6 per hour and the unskilled Rs. 4.50 per hour. The skilled labour is located in a machining department and the unskilled labour in an assembly department. A five-day week of 37-1/2 hours is worked and each accounting period is for four weeks.

Variable overhead per sub-assembly is *A* Rs. 5, *B* Rs. 4 and *C* Rs. 3.50.

At the end of the current year, stocks are expected to be as shown below but because interest rates have increased and the company utilises a bank overdraft for working capital purposes, it is planned to effect a 10% reduction in all finished sub-assemblies and bought-in stocks during Period 1 of the forthcoming year.

Forecast stocks at current year end :

<i>Sub-assembly</i>		<i>Copper frames</i>	
<i>A</i>	300	<i>Component D</i>	4,000
<i>B</i>	700	<i>Component E</i>	10,000
<i>C</i>	1,600	<i>Component F</i>	4,000

Work in progress stocks are to be ignored.

Overhead for the forthcoming year is budgeted to be Production Rs. 7,28,000. Selling and Distribution Rs. 3,64,000 and Administration Rs. 3,38,000. These costs, all fixed, are expected to be incurred evenly throughout the year and are treated as period costs.

Within Period 1 it is planned to sell one thirteenth of the annual requirements which are to be the sales necessary to achieve the company profit target of Rs. 65,00,000 before tax.

You are required to prepare budgets in respect of Period 1 of the forthcoming year for

- (i) Sales, in quantities and value;
- (ii) production, in quantities only;
- (iii) materials usage, in quantities;
- (iv) materials purchases, in quantities and value;
- (v) manpower budget, *i.e.* numbers of people needed in each of the machining department and the assembly department.

Solution.

	A 1	:	B 2	:	C 4	Total
Sales ratio						
Required profit (annual)						Rs. 65,00,000
Required profit (Period 1) (1/13th of annual profit)						5,00,000
1. Selling price per unit	Rs. 215		Rs. 250		Rs. 300	*
2. Variable cost per unit :						
Frame	20		20		20	
Component D	40		8		24	
Component E	5		35		25	
Component F	12	57	15	58	3	52
<i>Labour</i>						
Skilled	12		9		9.0	
Unskilled	9	21	9	18	13.5	22.5
V. Production overhead	5		4		3.5	
Total variable costs	103		100		98	
3. Contribution (1 - 2)	112		150		202	
4. Contribution × Sales ratio	112		300		808	1,220
5. Required contribution for period 1			*			

Fixed Costs :

Production	Rs. 56,000
Selling and distribution	28,000
Administration	26,000
Desired profit	1,10,000
Desired contribution	5,00,000
	6,10,000

Sales mix required for each period = Rs. 610,000 ÷ 1220 = 500

	A	B	C
(i) Sales quantity (Ratio 1:2:4)	500	1,000	2,000
Selling price (Rs.)	215	250	300
Sales value (Rs.)	1,07,500	2,50,000	6,00,000
(ii) Production in quantities only			
Sales quantities [as in (i)]	500	1,000	2,000
Add: Closing stock*	270	630	1,440
Total	770	1,630	3,440
Less: Opening Stock	300	700	1,600
Production	470	930	1,840

(iii) Material usage in quantities

	A	B	C	Total
Frame (1 each)	470	930	1,840	3,240
Component D (5,1,3)	2,350	930	5,520	8,800
Component E (1,7,5)	470	6,510	9,200	16,180
Component F (4,5,1)	1,880	4,650	1,840	8,370

(iv) *Material purchases in quantities and values*

	<i>Frames</i>	<i>D</i>	<i>E</i>	<i>F</i>
Closing Stock*	900	3,600	9,000	3,600
Add: Used in production	3,240	8,800	16,180	8,370
Total	4,140	12,400	25,180	11,970
Less: Opening Stock	1,000	4,000	10,000	4,000
Quantity Purchased	3,140	8,400	15,180	7,970
Buying cost per unit (Rs.)	20	8	5	3
Value of materials (Rs.)	62,800	67,200	75,900	23,910

(v) *Manpower Budget*

	<i>Machining Hours</i>	<i>Assembly Hours</i>
<i>Units produced x hours per unit</i>		
A (470 × 2 ; 470 × 2)	940	940
B (930 × 1.5 ; 930 × 2)	1,395	1,860
C (1,840 × 1.5 ; 1,840 × 3)	2,760	5,520
	5,095	8,320

Accounting year's hours = 4 weeks × 37.5 = 150 hrs. 5095 + 150 = 34;

Manpower required 5095 + 150 = 34; 8320 + 150 = 56

Problem 229. Marginal Costing vs. Absorption Costing. A manufacturer of glass bottles has been affected by competition from plastic bottles and is currently operating at between 65 and 70 per cent of maximum capacity. From the accounting records the following figures were extracted:

Standard cost per gross (A gross is 144 bottles and is the cost unit used within the business.):

Direct materials	Rs. 8.00
Direct labour	7.20
Variable production overhead	3.36
Total variable production cost	18.56
Fixed production overhead	7.52 *
Total production standard cost	26.08

*The fixed production overhead rate was based on the following computations:

Total annual fixed production overhead was budgeted at Rs. 75,84,000 or Rs. 6,32,000 per month.

Production volume was set at 1,008,000 gross bottles or 70 per cent of maximum capacity.

There is a slight difference in budgeted fixed production overhead at different levels of operating:

<i>Activity level</i>	<i>Amount per month</i>
Per cent of maximum capacity	Rs. '000
50 — 75	632
76 — 90	648
91 — 100	656

You may assume that actual fixed production overhead incurred was as budgeted.

* Opening stock quantities reduced by 10%.

Additional information :

	September	October
Gross sold	87,000	101,000
Gross produced	1,15,000	78,000
Sales price, per gross	Rs. 32	Rs. 32
Fixed selling costs	Rs. 1,20,000	Rs. 1,20,000
Fixed administrative costs	Rs. 80,000	Rs. 80,000

There were no finished goods in stock at 1 September.

You are required to prepare monthly profit statement for September and October using :

(i) absorption costing ; and (ii) marginal costing.

Solution. (i) *Statement showing profits for the months September and October under Absorption Costing*

	September		October	
	Rs. '000	Rs. '000	Rs. '000	Rs. '000
Sales (Gross sold × S. P. per Gross)		2,784.00		3,232.00
Less: Cost of production :				
Opening stock			730.24*	
Production Cost	2,999.20*		2,034.24*	
Total	2,999.20		2,764.48	
Less C/stock	730.24*		130.40	
		2,268.96		2,634.08
Gross Profit		515.04		597.92
Add/Deduct over/ (under) absorption (see working note)		208.80		(45.44)
		723.84		552.48
Less: Fixed Selling costs	120.00		120.00	
Fixed Adm. costs	80.00	200.00	80.00	200.00
Net Profit		523.84		352.48

	September	October
	Rs. '000	Rs. '000
* Production Cost		
September 115,000 units × Rs. 26.08 =	2999.2	
October 78,000 units × Rs. 26.08 =		2,034.24
Closing stock		
September (115,000 - 87,000) × Rs 26.08	730.24	
Closing stock for September becomes the opening stock for October		
Closing stock for October (O/stock + Production) - Sales		
[(28,000 + 78,000) - 1,01,000] × Rs. 26.08		130.40

Working Notes

Production at 70% capacity = 10,08,000 gross p.a.

Production at 100% capacity = 10,08,000 + 0.7 = 14,40,000 gross p.a.

Production per month at 100% capacity = 1,20,000 gross

	September	October
Actual production (units)	1,15,000	78,000
Capacity utilization	96%	65%
Production overhead	Rs. 6,56,000	6,32,000

Fixed overhead absorbed

1,15,000 units × Rs. 7.52

8,64,800

78,000 units × Rs. 7.52

—

5,86,560

Over (under) absorption

2,08,800

(45,440)

(ii)

*Statement showing the profits under
Marginal Costing for September and October*

Contribution per unit Rs. 32 – 18.56 = Rs. 13.44

	September		October	
	Rs.'000	Rs.'000	Rs.'000	Rs.'000
Total contribution (qty. sold × unit contribution)		1,169.28		1,357.44
Less: Fixed costs:				
Production	656		632	
Selling	120		120	
Administration	80		80	
		856.00		832.00
Net profit		313.28		525.44

***Problem 230. (Further Processing—use of Equivalent Concept.)** A plastic feedstock processor has three departments: mixing, refining and dressing. Raw materials are processed in the Mixing Department and two joint products are produced, known as Product R and Product D. These products can either be sold at the split-off point or processed further in the Refining and Dressing Departments and sold at enhanced prices. Financial statements for the last period for the three Departments are given below, together with additional data.

Mixing Department - Cost Statement

	Kgs.	Rs.	Transfers		Kgs.	Rs.
Opening WIP	14,500	8,700	—Direct sales	R	50,500	25,025
Direct materials	460,500	1,52,850	--Direct sales	D	8,250	4,117
Processing costs		76,360	—Refining Dept	R	2,99,525	149,493
			—Dressing Dept	D	1,08,425	54,115
			Closing WIP		8,300	4,980
	475,000	2,37,910			4,75,000	2,37,910

Mixing Department — Cost Statement

		Kgs	Rs.			Kgs.	Rs.
Costs	R	50,500	25,205	Sales	R	50,500	30,300
Profits from	R		5,095				
Costs	D	8,250	4,117	Sales	D	8,250	4,538
Profits from	D		421				
		58,750	34,838			58,750	34,838

Refining Department

	<i>Kgs</i>	<i>Rs.</i>		<i>Kgs</i>	<i>Rs.</i>
Opening WIP	9,300	7,626			
Transfers from Mixing Dept.	2,99,525	1,49,493	Sales	294,505	265,055
Processing costs		1,19,254	Closing Wip	14,320	11,742
Profit		424			
	3,08,825	2,76,797		3,08,825	2,76,797

Dressing Department

	<i>Kgs</i>	<i>Rs.</i>		<i>Kgs</i>	<i>Rs.</i>
Opening WIP	200	170			
Transfers from Mixing Dept.	1,08,425	54,115	Sales	1,07,425	1,12,796
Processing costs		62,774	Loss		3,243
			Closing WIP	1,200	1,020
	1,08,625	1,17,059		1,08,625	1,17,059

Additional Information

(i) Comparative outputs and processing costs in the preceding period were :

<i>Department</i>	<i>Kgs processed</i>	<i>Processing cost</i>
Mixing	510,000	Rs. 81,000
Refining	350,000	132,500
Dressing	105,000	61,750

(ii) Any fixed costs in the Mixing Department are incurred by that Department alone whereas any fixed costs in the Refining and Dressing Departments are allotted fixed costs of the company as a whole.

(iii) All work-in-progress is complete as regards materials and 50% complete as regards processing costs.

(iv) Sales can be made at any stage to suit the firm and production levels can be altered readily.

After studying the financial statements, the Managing Director thinks that the products should be sold at the split-off point where reasonable profits can be made and the Refining and Dressing Departments closed down.

- You are required to analyse the position and present figures relevant to the Managing Director's assertion.
- Based on these figures, and ignoring all other factors, what is the best course of action for the firm ? Evaluate its effect.
- Discuss the principles on which the financial statements have been prepared and their validity for decision making.

Solution : First of all it is necessary to find out material processed in the Department, variable cost by using high-low method, fixed cost and selling price per kg. PU denotes the physical units and EU denotes equivalent units.

Step 1—Statement of equivalent productions.

	Mixing		Refining		Dressing	
	FU (Kgs.)	EU ^a (Kgs.)	R _u (Kgs.)	Eu ^a (Kgs.)	FU (Kgs.)	EU ^a (Kgs.)
Closing stock (a)	8,300	4,150	14,320	7,160	1,200	600
Add: Output	50,500	8,250				
	2,99,525	1,08,425				
(b)	4,66,700	4,66,700	2,94,505	2,94,505	1,07,425	1,07,425
Less: Opening stock (c)	14,500	7,250	9,300	4,650	200	100
New Units Introduced (Materials processed (a) + (b) - (c))	4,60,500	4,63,600	2,99,525	2,97,015	1,08,425	1,07,925

Step 2—Calculation showing variable cost per unit

	Kgs	R _r	Kgs.	R _r .	Kgs.	R _r .
High	5,10,000	8,10,000	3,50,000	1,32,500	1,07,925	62,774
Low	4,63,600	76,360	2,97,015	1,19,254	1,05,000	61,750
	46,400	4,640	52,925	13,246	2,925	1,024
Variable cost per unit		0.10		0.25		0.35

Step 3—Calculation showing fixed costs

Total Costs	81,000	1,32,500	62,774
Less: Variable costs	51,000	87,500	37,774
Fixed costs	30,000	45,000	25,000

Selling Prices per Kg.

Direct from Mixing	R (Rs. 30,300 + 50,500)	Re. 0.60
	D (Rs. 4,538 + 8,250)	0.55
From Processing	R (Rs. 2,65,055 + 2,94,505)	0.90
	D (Rs. 1,12,796 + 1,07,425)	1.05

(a) (i) Contribution per Kg. from Refining

Selling price per kg. (processing)	Re 0.90
Selling price per kg. (mixing)	0.60
Gain in selling price on processing	0.30
Less: additional variable cost on refining	0.25
Contribution per kg	0.05

Contribution per kg. from Dressing

Selling price per kg. (processing)	Rs. 1.05
Selling price per kg (mixing)	0.55
Gain in selling price on processing	0.50
Less: additional variable cost on dressing	0.35
Contribution per kg.	0.15

Conclusion : Further processing is profitable in both cases in the short-run. However, contribution from dressing is much more than refining.

^aAll WIP complete as regards materials and 50% complete as regards processing costs.

However, it is given in the question that further processing in R and D are inevitable.

(b) The best strategy would be to process all output and sell at higher prices. The revised statements can be prepared using :

- (i) variable costs and contribution approach
- (ii) the external selling prices from Mixing Department as transfer prices
- (iii) continuing to use the same stock valuation calculations.

But alternative (i) has been used in the solution.

Mixing Department

	Kgs.	Rs.	Kgs.	Rs.	
Opening stock	14,500	8,700	Refining	3,50,025*	2,10,015 (A)
Materials	4,60,500	1,52,850	Dressing	1,16,675@	64,171 (B)
Processing - variable cost (4,63,600 × 0.10)		46,360	Closing stock	8,330	4,980
Contribution (balance)		71,256			
	4,75,000	2,79,166		4,75,000	2,79,166

Refining Department

Opening stock	9,300	7,626	Sales	3,45,005*	3,10,505(C)
From mixing	3,50,025	2,10,015	Closing stock	14,320	11,742
Processing - variable cost (3,47,515 × 0.25)		86,879			
Contribution (balance)		17,727			
	3,59,325	3,22,247		3,59,325	3,22,247

Dressing Department

Opening stock	200	171	Sales	1,15,675⊕	1,21,459(D)
From mixing	1,16,675	64,171	Closing stock	1,230	1,020
Processing - variable cost (1,16,175 × 0.35)		40,661			
Contribution (Balance)		17,477			
	1,16,875	1,22,479		1,16,875	1,22,479

Summary of Results

	Mixing	Refining	Dressing	Total
Contribution	Rs. 71,256	Rs. 17,727	Rs. 17,477	Rs. 1,06,460
Fixed costs	30,000	45,000	25,000	1,00,000
Profit/(Loss)	41,256	(27,273)	(7,523)	6,460
Previous Profit/(Loss)	5,511	425	(3,243)	2,697
				3,763

This shows the short-term advantages of a full processing strategy and longer term problems of which the Managing Director is probably aware.

(c) Any form of allocation or apportionment can be misleading for decision-making purposes. In this problem, there are a number of arbitrary calculations such as :

* 2,99,525 + 50,500	=	3,50,025	made up from 50,500 × 0.05	= Rs. 2,525
@ 108,425 + 8,250	=	1,16,675	8,250 × 0.15	= 1,230
# 50,500 + 294,505	=	3,45,005	For Re. 0.05 and Re. 0.15 refer to (4)	3,763
⊕ 8,250 + 1,07,425	=	1,15,675		

- (i) the joint costs are apportioned by weight.
- (ii) average cost is used as a transfer price despite the availability of market price.
- (iii) fixed and variable costs determination.
- (iv) general fixed costs *not* separated are charged to Refining and Dressing Departments.

The consequences of these conclusions are illustrated by comparative statements. A further improvement would be desirable, separating departmental and company fixed costs.

Authors' Notes :- This is a unique problem from CIMA. For deciding whether further processing is worthwhile or not, find out additional processing cost and arrive at the conclusion. Part (B) of the question is based on contribution analysis. In mixing department sale to refining and dressing has been taken at market rate available to the department in open market.

(A) $3,50,000 \times 0.60 = \text{Rs. } 2,10,015$. Valued at market price of mixing department i.e., $\text{Rs. } 30,300 + 50,500 = \text{Rs. } 0.60$

(B) $1,16,675 \times 0.55 = \text{Rs. } 64,171$. Valued at market price of mixing department i.e. $\text{Rs. } 4,538 + 8,250 = \text{Rs. } 0.55$ for direct sale of product D

(C) $3,45,005 \text{ units} \times \text{Rs. } 90 = \text{Rs. } 3,10,505$ i.e., price of refining department i.e. $\text{Rs. } 2,65,050 + 2,94,505 = \text{Rs. } 0.90$

(D) $\text{Rs. } 1,15,675 \text{ units} @ \text{Rs. } 1.05 = \text{Rs. } 1,21,459$ i.e., price of dressing department i.e., $\text{Rs. } 1,12,796 + 1,07,425 = \text{Rs. } 1.05$

Problem 231. (Team Composition, Productivity and Efficiency Variances.) A large manufacturing company with a diverse range of products is developing the use of standard costing throughout its divisions. A full standard costing system has already been implemented in Division A, including the use of mix and yield material variances, and attention has now turned to Division B where the main problem concerns labour.

Division B makes highly complex work stations which incorporate material handling, automatic controls and robotics. Manufacture is a team effort and the team specified for work station No. 26 comprises.

- 2 supervisors paid Rs. 8 per hour
- 10 fitters paid Rs. 6 per hour
- 6 electricians paid Rs. 6 per hour
- 2 electronics engineers paid Rs. 7 per hour
- 4 labourers paid Rs. 4 per hour

Output is measured in standard hours and 90 standard hours are expected for every 100 clock hours. During a period the following data were recorded.

	<i>Actual hours</i>	<i>Actual pay</i>
Supervisors	170	Rs. 1,394
Fitters	820	4,920
Electricians	420	2,562
Electronics engineers	230	1,725
Labourers	280	1,120
Total	1,920	Rs. 11,721

1,650 standard hours were produced.

The factory director of Division B is anxious to gain the maximum information possible from the standard costing system. He sees no reason why the normal labour efficiency variance could not be divided into sub-variances in order to show separately the effects of non-standard team composition and team productivity in a similar fashion to the material usage variance which can be sub-divided into mix and yield variances. You are required (a) to calculate the labour rate variance ; (b) to calculate :

- (i) the team composition variance; (ii) the team productivity variance and (iii) labour efficiency variance.

Solution. Workings :

<i>Standard Composition</i>	<i>Proportion</i>
2 Supervisor	0.083
10 Fitters	0.417
6 Electricians	0.250
2 Electronic Engineers	0.083
4 Labourers	0.167
<u>24</u>	<u>1.000</u>

Input in hours = $(10/9) \times 1650 = 1833$ hours

L₁—Actual Payment to workers for actual hours worked (Given)

	<i>Actual hours</i>	<i>Total Payments</i>
Supervisors	170	1,394
Fitters	820	4,920
Electricians	420	2,562
Electronic Engineers	230	1,725
Labourers	280	1,120
	<u>1,920</u>	<u>11,721</u>

L₂—Payment involved, if the workers had been paid at standard rate.

	<i>Actual hours</i>	<i>Std. Rate</i>	<i>Amount</i>
Supervisors	170	Rs. 8	Rs. 1,360
Fitters	820	6	4,920
Electricians	420	6	2,520
Electronic Engineers	230	7	1,610
Labourers	280	4	1,120
	<u>1,920</u>		<u>11,530</u>

L₃—Payment involved, if the workers had been used according to proportion of standard gang and the payment had been made at standard rate.

	<i>Hours</i>	<i>Std. Rate</i>	<i>Amount</i>
Supervisors	$1,920 \times 0.083 =$	159.36* × Rs. 8	Rs. 1,274.88
Fitters	$1,920 \times 0.417 =$	800.64 × 6	4,803.84
Electricians	$1,920 \times 0.25 =$	480.00 × 6	2,880.00
Elect. Engineers	$1,920 \times 0.083$	159.36 × 7	1,115.52
Labourers	$1,920 \times 0.167$	320.64 × 4	1,282.56
	<u>1,920</u>		<u>11,356.80</u>

L_4 —No idle time variance because nothing given to conclude that there was idle time.

L_5 —Standard labour cost of output achieved

	Std. hours		Rate	Amount
Supervisors	$1,833 \times 0.083$	$= 152.14$	\times Rs. 8	Rs. 1,217.12
Fitters	$1,833 \times 0.417$	$= 764.36$	\times 6	4,586.16
Electricians	$1,833 \times 0.25$	$= 458.25$	\times 6	2,749.50
Elect. Engineers	$1,833 \times 0.083$	$= 152.14$	\times 7	1,064.98
Labourers	$1,833 \times 0.167$	$= 306.11$	\times 4	1,224.44
		<u>1,833</u>		<u>10,842.20</u>

(a & b) :

$$\text{Wage Rate Variance} = L_1 - L_2 = 11,721 - 11,530 = \text{Rs. } 191 \text{ (A)}$$

$$\text{Wage Gang Variance} = L_2 - L_3 = 11,530 - 11,356.80 = 173.20 \text{ (A)}$$

$$\text{Wage Yield variance or team productivity variance} = L_3 - L_5 =$$

$$11,356.80 - 10,842.20 = 514.60 \text{ (A)}$$

$$\text{Wage Efficiency Variance} = L_2 - L_5 = 11,530 - 10,842.20 = 687.80 \text{ (A)}$$

Problem 232. Poisson Distribution—Test of Hypothesis. A tool hire company has six cement mixers for hire but complaints have been received about the non-availability of mixers and the manager is wondering whether to increase the number available. Fortunately, detailed statistical records have been kept and the following data are available for the rest 1,000 working days.

Daily Demand (No. of mixers)	No. of occasions
0	11
1	35
2	81
3	143
4	176
5	177
6	149
7	108
8	65
9	37
10	18
	<u>1,000</u>

The manager would like to offer a 95% service level but does not know how many mixers to have available. Having had some statistical training, he suspects that the demand data approximates to a Poisson Distribution. You are required :

(a) to test the hypothesis that the observed data approximates to a Poisson Distribution ;

(b) to calculate the number of mixers required to give a 95% service level, assuming that it is valid to forecast the same demand distribution as in the last 1,000 days.

Solution.

(a)	Daily demand (x)	No. of occasions (o)	Demand x occasions (ox)	Expected Poisson $x = 4.9 (E)$	Chi Sq. Test $(O-E)^2$	Cumulative Poisson sum to 0.95
	0	11	0	7.45 *	1.75	.0074
	1	35	35	36.5	0.06	0.0439
	2	81	162	89.4	0.79	0.1333
	3	143	429	146.0	0.06	0.27935
	4	176	704	178.9	0.05	0.4582
	5	177	885	175.3	0.02	0.6335
	6	149	894	143.2	0.23	0.7767
	7	108	756	100.2	0.61	0.8769
	8	65	520	61.4	0.21	0.9383
	9	37	333	33.4	0.39	0.9717
	10	18	180	16.4	0.16	0.9881
		<u>1,000</u>	<u>4,898</u>		<u>$x^2 = 4.33$</u>	

$$x = 4,898 \div 1,000 = 4.9$$

* From Poisson Distribution table value of 4.9 is 7.45

$$f(0) = 7.45 \text{ (from table)}$$

$$f(1) = (4.9) (7.45) = 36.5$$

$$f(2) = \left(\frac{4.9}{2}\right) (36.5) = 89.4$$

$$f(3) = \left(\frac{4.9}{3}\right) (89.4) = 146.0$$

$$f(4) = \left(\frac{4.9}{4}\right) (146.0) = 178.9$$

$$f(5) = \left(\frac{4.9}{5}\right) (178.9) = 175.3$$

$$f(6) = \left(\frac{4.9}{6}\right) (175.3) = 143.2$$

$$f(7) = \left(\frac{4.9}{7}\right) (143.2) = 100.2$$

$$f(8) = \left(\frac{4.9}{8}\right) (100.2) = 61.4$$

$$f(9) = \left(\frac{4.9}{9}\right) (61.4) = 33.4$$

$$f(10) = \left(\frac{4.9}{10}\right) (33.4) = 16.4$$

H_0 Distribution is Poisson

H_1 Distribution is not Poisson

5% level

x from table with $(11 - 2) = 9$

degree of freedom = 16.92 [From Percentiles for the chi-Sq. Distribution value of 9 with 5% level]

As the calculated value is well below this, it can be accepted that distribution approximates to a Poisson Distribution.

(b) It is observed from the last column (cumulative Poisson) of (a) above, that total 9 mixers are required. As the company has only 6 mixers, additional 3 mixers have to be acquired.

Problem 233. (Fixing retail prices for a new product.) AB Ltd. is a well-established company producing high quality, technically advanced, electronic equipment.

In an endeavour to diversify, it has identified opportunities in the hi-fi industry. After some preliminary market research it has decided to market a new product that incorporates some of the most advanced techniques available together with a very distinctive design.

AB Ltd's special skill is that it can apply these techniques economically to medium-sized quantities and offer a product of excellent design with an advanced degree of technology.

Category	Technology	Design	Quantities sold per annum	Number of models	Retail selling price range (Rs.)
1	Good	Standard	22,000	4	600 - 1,050
2	Good	Good	6,000	5	1,450 - 1,900
3	Advanced	Good	750	2	2,500 - 3,000

The product will be distributed through a range of specialist retailers who have undertaken not to discount prices. Their commission will be 25% on retail selling price. AB Ltd has also acquired the rights to sell the product under the name of a prestigious hi-fi manufacturer who does not offer this type of product. For this it will pay a royalty of 5% of the retail selling price.

AB Ltd. assesses that its direct cost per product will be Rs. 670 (excluding the royalty and the retailers commission) and the annual fixed costs relevant to the project are budgeted at :

Production	Rs. 2,50,000
Research and development	50,000
Marketing	2,00,000
Finance and administration	50,000

You are required, from the data provided and making such assumptions as you consider reasonable,

- to suggest a range of retail prices (*i.e.* to the consumer) from which AB Ltd should choose the eventual price for its product. Explain briefly why you have suggested that range of prices;
- to select one particular price from the range in (a) above that you would recommend AB Ltd to choose.

Explain, with any relevant calculations, why you have recommended that price. Mention any assumptions that you have made.

Note: The prices suggested should be rounded to the nearest Rs. 100.

Ignore tax (or sales taxes) and inflation.

Solution:

It is given that the new product of AB Ltd. faces three categories of competitors. These three categories of competitors produces 11 models (4 + 5 + 2) and in other words the company is facing competition from 11 competitors. The market's present annual sales are 28,750 units. As the present price range is very wide from Rs. 600 to Rs. 3,000 per unit, it can be assumed that the market requirements are fairly well met. The market is only likely to be significantly, expanded by a unit price below the present Rs. 600. The given quantitative details can be further analysed as under :

Category	Quantities sold p a.	%	No. of models	Average per model/ competitor
1	22,000	76.5	4	5,500
2	6,000	20.9	5	1,200
3	750	2.6	2	375
	<u>28,750</u>	<u>100.0</u>	<u>11</u>	

Thus the overall average works out to 2614 units, (i.e., 28,750 ÷ 11). In view of this, a medium output can be assumed as 3,000 units. This output is about half of the large manufacturers' output and more than twice that of the smaller manufacturers' output.

By finding out the B.E. selling price of AB Ltd, it will be easy to determine the categories of customers. The break-even cost is as under :

Direct cost per unit	Rs. 670
Fixed cost (Rs. 550,000 ÷ 3000)	183
	<u>853</u>

With retailers' commission at 25% of S.P. and royalty of 5% of S.P., then the S.P. will be Rs. 1219, i.e., 853 × 100/70. This means that AB Ltd. will not be able to compete in category 1.

Category 2 (price range Rs. 1450 – 1900) seems to be logical sector, but here it would need to capture half the market. However, it would not be difficult with a model superior both in technology and design. In fact the new unit will be in some ways better than the category 3 models in the price range Rs. 2,500 – Rs. 3,000. It might be assumed, therefore, that 2,750 units could be from category 2 and 250 from category 3. Both the suggested levels will have substantial impact on each category taking in category 2—46% of that market and in category 3—33% of that market. This will result in price cutting more by the existing manufacturers.

Overall the price range in category 2 may drop to Rs. 1,300—1,700. Any price within this range would show a profit to AB Ltd on sales of 3000 units. Therefore, the suggested price range should be from Rs. 1,300 to Rs. 1,700.

Now, the company has to choose from within the range ?

Customers buy at price from Rs. 1,450—1,900. If these are proportionately those between price range of Rs. 1,300—1,700 (2,700 customer) and those from Rs. 1700—1900 (300 customer). So it is almost certain that 2,700 customers

would buy the superior model if it was offered at Rs. 1,700. The following table shows the probability at price of Rs. 1,500, Rs. 1,600 and Rs. 1,700 at production levels of 3,000 and 2,000 units per year.

Units per year	3,000			2,000		
Price per unit (Rs.)	1,500	1,600	1,700	1,500	1,600	1,700
Less: Royalty - 5%	75	80	85	75	80	85
Commission - 25%	375	400	425	375	400	425
Selling price (Net)	1,050	1,120	1,190	1,050	1,120	1,190
Less: Direct costs	670	670	670	670	670	670
Contribution per unit	380	450	520	380	450	520
Total contribution	1,140	1,350	1,560	760	900	1,040
Less: Fixed costs	550	550	550	550	550	550
Profit	590	800	1,010	210	350	490

It is observed from the above table that if price is set at Rs. 1,700 per unit when 3,000 units are sold, the profit would be optimum at Rs. 10,10,000.

What profit is acceptable? There is no clear indication of the capital employed in the business. Assuming that the production fixed costs of Rs. 2,50,000 are mainly in respect of depreciation on fixed assets at a rate of say 10% p.a. then the capital cost would be about Rs. 25,00,000. Allowing Rs. 5,00,000 for working capital, capital employed would amount to Rs. 30,00,000. So the ROCE would be 33% when profit is Rs. 10,10,000 and 7% when profit is Rs. 2,10,000. A likely figure, therefore, arising from a reduction in selling price and/or lower sales might be in the acceptable region of over 20%.

It is, therefore recommended that initial selling price of the new units be set at Rs. 1,700 per unit.

Problem 234. (Capital Budgeting - whether or not to buy cars for sales staff.) PQ plc employs 40 sales staff who use their own cars for 25,000 miles per annum on company business for which they are reimbursed at the rate of Rs. 0.23 per mile.

The company is considering whether or not to end this system and buy cars for the sales staff. Enquiries show that the capital cost of the cars will be Rs. 10,000 each with a four-year life and that there will be a resale value of Rs. 3,000 each at the start of year 5. The costs per car per annum are expected to be Rs. 1,300 for petrol and oil, and Rs. 450 for tax and insurance. Repair and maintenance costs per car have been quoted by Y Ltd. (see below) as:

	Year 1	Year 2	Year 3	Year 4
Costs per annum	Rs. 200	Rs. 900	Rs. 1,250	Rs. 1,400

Capital allowances on the original cost are 25% p.a. on a reducing balance and the company has adequate profits to absorb those allowances. The company pays 35% corporation tax; this is paid one year after the profit is earned and credit for tax on capital allowances is similarly delayed by one year. The company's cost of capital for this type of transaction is 20% DCF before tax.

PQ plc owns a subsidiary, Y Ltd. whose business is the repair and maintenance of cars and vans. Y Ltd. has undertaken to repair the sales staff's cars at well below the price that the sales staff would have had to pay for such repairs elsewhere, and this facility is currently being used by 70% of the sales staff. Y Ltd. would be able to undertake all service work that PQ plc would require if it decides to buy its own cars.

To finance the purchase price of the cars, PQ plc has two options :

1. to obtain an unsecured loan, repayable at the end of year 4, at a 16% rate of interest payable annually; or

2. to accept an offer of Rs. 400,000 (to be paid on signing the contract) made by the management of Y Ltd. for a buy-out of all of the share capital of that company. A condition is that Y Ltd. receives a contract for the repair and maintenance of PQ plc's new fleet for a period of three years on terms similar to those that now apply for the sales staff's cars. At present Y Ltd is just breaking even.

You are required (a) to recommend whether PQ plc should change to the purchase of cars for the sales staff if it raises the funds to finance the purchase price by :

(i) option 1, (ii) or by option 2.

Solution. (a) Based on one car - 40 involved in total

Present System

Reimbursement to sales staff for use of their car 25,000 miles at Re. 0.23 per mile = Rs. 5,750 per year.

Allowable for tax at 35% delayed by one year.

Year	Payment Rs.	Tax benefit Rs.	Net Cash Flow Rs.	Discounting factor 13% (Note 1)	Present value Rs.
1	(5,750)	—	(5,750)	0.88	(5,060)
2	(5,750)	2,012	(3,738)	0.78	(2,916)
3	(5,750)	2,013	(3,737)	0.69	(2,579)
4	(5,750)	2,012	(3,738)	0.61	(2,280)
5	—	2,013	2,013	0.54	1,087
Discounted Cost					(11,748)

Proposed System : Purchased car at Rs. 1,00,000 with four year life and a residual value of Rs. 3,000.

Costs	1st Year	2nd Year	3rd Year	4th Year
	Rs.	Rs.	Rs.	Rs.
Petrol and Oil	1,300	1,300	1,300	1,300
Tax and Insurance	450	450	450	450
Repair	200	900	1,250	1,400
Total	1,950	2,650	3,000	3,150

Capital allowances 25% on the reducing balance—Tax payments are delayed by one year

(i) Option 1— To finance with a long term loan

at 16% payable annually

Year	Purchase			Costs		Loan		Net Cash Flows
	Cash flows	Tax benefit Refer to Note 2	Cash flows	Tax benefits at 35%	Cash flows	Interest	Tax benefits @ 35%	
0	(10,000)	—	—	—	10,000	—	—	—
1	—	—	(1,950)	—	—	(1,600)	—	(3,550)
2	—	875	(2,650)	682	—	(1,600)	560	(2,133)
3	—	656	(3,000)	928	—	(1,600)	560	(2,456)
4	—	492	(3,150)	1,050	(10,000)	(1,600)	560	(12,648)
5	3,000	369	—	1,102	—	—	560	5,031
6	—	57	—	—	—	—	—	57
								(15,699)

Discounted Value of Cashflow relating to Option 1

Year	Net Cash flows (as above)	Discounting factor 13%	Present Value
0	---	1.00	---
1	(3,550)	0.88	(3,124)
2	(2,133)	0.78	(1,664)
3	(2,456)	0.69	(1,695)
4	(12,648)	0.61	(7,715)
5	5,031	0.54	2,717
6	57	0.48	27
Total Cash Flows	(15,699)		
Discounted Cost			(11,454)

(ii) Option 2 - To finance by selling Y Ltd. and using the cash to finance the purchase of the cars.

Year	Purchase		Costs		Net Cash Flow	Discounting Factor 13%	Present value
	Cash flows.	Tax benefit Refer Note 2	Cash-flows (as per details above)	Tax benefits			
0	(10,000)	—	—	—	(10,000)	1.00	(Rs.10,000)
1	—	—	(1,950)	—	(1,950)	0.88	(1,716)
2	—	875	(2,650)	682	(1,093)	0.78	(852)
3	—	656	(3,000)	928	(1,416)	0.69	(977)
4	—	492	(3,150)	1,050	(1,608)	0.61	(981)
5	3,000	369	—	1,102	4,471	0.54	2,414
6	—	57	—	—	57	0.48	27
Discounted Cost							(12,085)

Summary

	<i>Per Car</i>	<i>For 40 Cars</i>
Discounted cost over four years		
Present reimbursement method	Rs. 11,748	Rs. 4,69,920
Option 1 - long term loan	11,454	4,58,160
Option 2 - Sell Y Ltd.	12,085	4,83,400

Recommendation

The company should change from the reimbursement system to the purchase of company cars financed by a long term loan at 16% (option 1).

The table above shows this to be the least cost method.

Note 1 — After tax cost of raising long term loans.

$$K_1 = K_d \times (1 - T)$$

where K_1 = After tax cost of debt ; K_d = Before tax cost of debt

T = Firm's tax rate

$$K_1 = 20\% \times (1 - 35\%) = 13\%$$

Note 2 - Tax benefit on purchase

<i>Year</i>	<i>Value on which capital allowance</i>	<i>Capital Allowance at 25% of Column 2</i>	<i>Tax benefit @ 35% of Annum</i>
(1)	(2)	(3)	(4)
1	—	—	—
2	10,000	2,500	Rs. 875
3	7,500	1,875	656
4	5,625	1,406	492
5	4,219	1,055	369
6	(4,219 - 1,055 - 3,000)	1674*	57
	or		
	164		

*This year capital allowance will not be allowed, but company will debit the written down value to profit and loss account. Therefore again tax benefit at 35% will be realised.

Problem 235. (Hotel Costing - ROCE.) A hotel budget for the year 1991 shows the following room occupancy :

	<i>Average %</i>
January — March	45
April — June	60
July — September	90
October — December	55

Revenue for the year is estimated to be Rs. 30,00,000 and arises from three profit centres:

Accommodation* 45%: Restaurant 35%: Bar 20%: Total 100%

*The accommodation revenue is earned from several different categories of guest, each of which pays a different rate per room.

The three profit centres have the following percentage gross margins.

	<i>Accommodation %</i>	<i>Restaurant %</i>	<i>Bar %</i>
Revenue	100	100	100
Wages	20	30	15
Cost of sales	—	40	50
Direct costs	10	10	5
Gross margin	70	20	30

Fixed costs for the year are estimated to be Rs 5,65,000.

Capital employed is Rs. 70,00,000.

As a means of improving the return on capital employed, following two suggestions have been made :

(i) to offer special two-night holidays at a reduced price of Rs. 25 per night. It is expected that those accepting the offer would spend an amount equal to 40% of the accommodation charge in the restaurant, and 20% in the bar.

(ii) to increase prices. Management is confident that there will be no drop in volume of sales if restaurant prices are increased by 10% and bar prices by 5%. Accommodation prices would also need to be increased.

You are required.

(a) to calculate the budgeted return on capital employed before tax.

(b) to calculate : (i) how many two-night holidays would need to be sold each week in the three off-peak quarter to improve the return on capital employed (ROCE) by a further 4% above the percentage calculated in (a) above ;

(ii) by what percentage the prices of accommodation would need to be increased to achieve the desired increase in ROCE shown in (b) (i) above ;

Solution

(a) Total revenue is given. Revenue for each profit centre is determined by applying different given percentages. Gross margin percentages have to be multiplied for finding out total gross margin. From this profit before tax has to be related to capital employed for the purpose of determining ROCE.

Profit Centre	Estimated Revenue		Gross Profit	
	%	Amount (Rs.)	%	Amount (Rs.)
Accommodation	45	13,50,000	70	9,45,000
Restaurant	35	10,50,000	20	2,10,000
Bar	20	6,00,000	30	1,80,000
	100	30,00,000		13,35,000
Less: Fixed Costs				5,65,000
Profit before tax				7,70,000
Capital employed				70,00,000

$$\text{ROCE} = \frac{7,70,000}{70,00,000} \times 100 = 11\%$$

(b) (i) Number of two-night holidays required to improve ROCE by a further 4%.

Additional return required @ 4% on Rs. 70,00,000 = Rs. 2,80,000. The reduced tariff is Rs. 25 per night and the same will be Rs. 50 for two nights. All those availing of special offer would spend an amount equal to 40% of the accommodation charge in the restaurant (Rs. 50 × 40% = Rs. 20) and 20% in the bar (Rs. 50 × 20% = Rs. 10). Thus extra contribution from each additional two night holiday will be :

	Sales per two-night holiday	G. Profit margin (%)	Extra contri- bution
Accommodation	Rs. 50	70	Rs. 35
Restaurant	20	20	4
Bar	10	30	3
			<u>42</u>

Number of holidays required to achieve the desired contribution :

$$\text{Rs. } 2,80,000 \div \text{Rs. } 42 = 6,667$$

Number of holidays in 3 off-peak quarters = $(52/4) \times 3 = 39$

Number of holidays per week for three quarters = $6,667 \div 39 = 171$

- (ii) *Accommodation price required to be increased to improve ROCE by a further 4%.*

Additional contribution required Rs. 2,80,000

Less return from :

Restaurant (10% of Rs. 10,50,000) = Rs. 1,05,000

Bar (5% of Rs. 6,00,000) 30,000 1,35,000

Required contribution from accommodation 1,45,000

Percentage increase in accommodation

$$\text{prices} = \frac{\text{Rs. } 1,45,000}{\text{Rs. } 13,50,000} \times 100 = 10.741\%$$

To achieve the desired increase in ROCE, accommodation prices are required to be increased by 11%.

Problem 236. (Activity Based Costing.) (a) "Cost drivers attempt to link costs to the scope of output rather than the scale of output thereby generating less arbitrary product costs for decision making." In the context of Activity Based Costing, you are required to explain the terms "activity based costing" and "cost drivers".

(b) XYZ plc manufactures four products, namely A, B, C and D, using the same plant and process. The following information relates to a production period:

Product	Volume	Material cost per unit	Direct Labour per unit	Machine time per unit	Labour cost per unit
A	500	Rs. 5	1/2 hour	1 1/4 hour	Rs. 3
B	5,000	5	1/2 hour	1 1/4 hour	3
C	600	16	2 hours	1 hour	12
D	7,000	17	1-1/2 hours	1-1/2 hours	9

Total production overhead recorded by the cost accounting system is analysed under the following headings :

Factory overhead applicable to machine-oriented activity is Rs. 37,424

Set-up costs are Rs. 4,355

The cost of ordering materials is Rs. 1,920

Handling materials : Rs. 7,580

Administration for spare parts Rs. 8,600

These overhead costs are absorbed by products on a machine hour rate of Rs. 4.80 per hour, giving an overhead cost per product of :

$$A = \text{Rs. } 1.20 \quad B = \text{Rs. } 1.20 \quad C = \text{Rs. } 4.80 \quad D = \text{Rs. } 7.20$$

However, investigation into the production overhead activities for the period reveals the following totals :

Product	Number of set-ups	Number of material orders	Number of times material was handled	Number of spare parts
A	1	1	2	2
B	6	4	10	5
C	2	1	3	1
D	8	4	12	4

You are required:

(i) to compute an overhead cost per product using activity based costing, tracing overheads to production units by means of cost drivers.

(ii) to comment briefly on the differences disclosed between overheads traced by the present system and those traced by activity based costing.

Solution:

(a) Traditional management accounting has used cost as a measure of resource consuming activity, so that cost headings can be viewed as a substitute for activity. Complex modern production systems require costs expressed in terms of activity to reveal the causes of costs. Activity based information may be non-financial, but concerns activities across the entire chain of value adding process, and focuses the attention of managers on activities that cause costs rather than the costs themselves. These activities are known as 'cost drivers'. Many processes within a business add cost to the product, directly or indirectly, but not all add value to the product. The differentiation between value adding and non-value adding activities is significant, since it identifies costs which can be cut without deterioration of the product. For example, the cost of holding stock does not add value to the product, and is therefore a promising activity for cost reduction.

A further example of cost drivers concerns the allocation of overheads to production units. Products manufactured in short runs generate more support department cost per unit than products made in long runs, but if such overheads are allocated to products per unit based on total volume, (DLH's or machine hours), all production units will receive the same charge. This undercosts short run products and overcharges long run products. Cost tracing based on arbitrary allocation rules, (e.g. cost drivers such as DLH's and machine hours) can lead to distortion because there is no real cause and effect relationship in a complex modern manufacturing system between the apportionment base and the cost to be apportioned. Production with a series of short run products creates manufacturing overhead derived from set up time and switching from one product to another. If such costs are allocated to production units on the basis of non-related activities, distortion will result. Cost drivers for activity based cost allocation should be selected because they relate to the scope and diversity of production rather than volume alone. Cost tracing based on activity recognised differences in the consumption of input costs which are ignored by a volume based system.

(b) (i) Factory overhead applicable to machine oriented activity = Rs. 37,424

Total Machine Hours = Volume \times machine hour required for each period

$$= (500 \times 1/4) + (5,000 \times 1/4) + (600 \times 1) + (7,000 \times 3/2) = 12,475 \text{ hrs.}$$

$$\text{Machine overhead charged} = \text{Rs. } 37,424 + 12,475 \text{ hrs.} = \text{Rs. } 3 \text{ per hour}$$

$$\text{Set up costs} = \text{Rs. } 4,355 + 17 \text{ (i.e. total number of set-ups)} = \text{Rs. } 256.18$$

$$\text{Material ordering cost} = \text{Rs. } 1,920 + 10 \text{ operations} = \text{Rs. } 192$$

$$\text{Material handling cost} = \text{Rs. } 7,580 + 27 \text{ operations} = \text{Rs. } 280.74$$

$$\text{Spare parts} = \text{Rs. } 8,600 + 12 \text{ parts} = \text{Rs. } 716.67$$

Overhead Items	Products			
	A Rs.	B Rs.	C Rs.	D Rs.
Machine overhead	$1/4 \times \text{Rs. } 3 = .75$	$1/4 \times \text{Rs. } 3 = .75$	$1 \times \text{Rs. } 3 = 3$	$3/2 \times \text{Rs. } 3 = 4.50$
Set-up cost	$\frac{1 \times 256.18}{500} = .51$	$\frac{6 \times 256.18}{5000} = .31$	$\frac{2 \times 256.18}{600} = .85$	$\frac{8 \times 256.18}{7000} = .29$
Material ordering cost	$\frac{1 \times 192}{500} = .38$	$\frac{4 \times 192}{5000} = .15$	$\frac{1 \times 92}{600} = .32$	$\frac{4 \times 192}{7000} = .11$
Material handling cost	$\frac{2 \times 280.74}{500} = 1.12$	$\frac{10 \times 280.74}{5000} = .56$	$\frac{3 \times 280.74}{600} = 1.40$	$\frac{12 \times 280.74}{7000} = .48$
Spare parts cost	$\frac{2 \times 716.67}{500} = 2.87$	$\frac{5 \times 716.67}{5000} = .72$	$\frac{1 \times 716.67}{600} = 1.19$	$\frac{4 \times 716.67}{7000} = .41$

(ii) Statement showing the overhead per unit based on two system and their difference.

Pro- ducts	Machine over- head	Set- ups	Material ordering	Material handling	Spare parts	Total (ABC system)	Old system	Difference
A	Rs. 0.75	Rs. 0.51	Rs. 0.38	Rs. 1.12	Rs. 2.87	Rs. 5.63	Rs. 1.20	+4.43
B	0.75	0.31	0.15	0.56	0.72	2.49	1.20	+1.29
C	3.00	0.85	0.32	1.40	1.19	6.76	4.80	+1.96
D	4.50	0.29	0.11	0.48	0.41	5.79	7.20	-1.41

The traditional system does not make correct assumptions that all overheads are related to volume and machine time. Under traditional system Products A and C are under costed because it misallocates costs for small volume products. The activity based system recognises the amount of input to each cost unit. Product B previously avoided its full share of overheads because of its low machine time and may still do so if part of Rs. 37,425 of machine-oriented overhead should be apportioned on some other basis. Product D is over-costed because the traditional system loaded it with overhead attributable to activities concerned with products A, B and C, as a result of using a volume-based and machine oriented rate which failed to pay proper attention to activity costing.

C.A. Inter May 1991

Problem 237. (Sales Mix - Principal Budget Factor being Labour Cost). In its budget for the period ahead 'X' Limited is considering two possible sales forecasts or its three products as follows :-

	Forecast		
	Product		
	A	B	C
I. Sales (Units)	22,000	40,000	6,000
Selling price per unit	Rs. 10	Rs. 6	Rs. 7.50
II. Sales (Units)	30,000	50,000	7,000
Selling price per unit	Rs. 9	Rs. 5.50	Rs. 7.50

Variable costs per unit are expected to be the same at the different levels of possible sales. The variable costs per unit are as follows :-

	Product		
	A	B	C
Direct materials	Rs. 3.00	Rs. 2.00	Rs. 4.00
Direct labour	2.00	1.50	1.00
Variable overheads	1.00	0.50	1.00

Fixed overheads are expected to total Rs. 1,00,000. These are expected to be unaffected by the possible changes in activity which are being considered. Due to recent high labour turnover problems, direct labour will be restricted to a maximum Rs. 1,30,000 in the period. It can be assumed that all labour is of the same grade and is freely transferable between products. Other resources are expected to be generally available.

Taking each of the possible sales forecasts in turn. You are required to :

- (i) Say what the principal budget factor is for each of the forecasts.
- (ii) For each forecast calculate the sales budget that you would recommend to maximise profits.
- (iii) What profit would you expect from each sales budget ?

Assume that the products will be sold according to the selling prices estimated as per the forecast and no interchange of the forecast is allowed.

Solution:

	Forecast I			
	Products			Total
	A	B	C	Rs.
Sales quantity (Units)	22,000	40,000	6,000	
Labour cost per unit (Rs.)	2	1.50	1	
Total labour cost (Rs.)	44,000	60,000	6,000	1,10,000
*Direct labour cost (Rs.)				1,30,000
*Maximum available				

In this case, as sales is the principal budget factor as the direct labour available is more than the total labour cost to meet the requirement of sales forecasted.

	Forecast II			
	Products			Total
	A	B	C	Rs.
Sales quantity (units)	30,000	50,000	7,000	
Labour cost per unit (Rs.)	2	1.50	1	
Total labour cost (Rs.)	60,000	75,000	7,000	1,42,000
*Direct labour available (Rs.)				1,30,000
*Maximum available				

In this case, labour is the principal factor.

Note: In most case, maximum possible labour is expressed in hours. However, in this problem, maximum direct labour is expressed in value. Even direct labour hours required are not given in the problem.

Forecast I

(Sales being principal budget factor)			
Products	Sales unit	S.P. per unit	Sales Value
A	22,000	Rs. 10.00	Rs. 2,20,000
B	40,000	5.50	2,40,000
C	6,000	7.50	45,000
Total Sales budget			<u>5,05,000</u>

In forecast II, direct labour is the limiting factors and as such total sales quantity will have to be recast keeping this in view :

Products	S.P. p.u.	V. Costs	Contri- bution	Contribution per Rs. of direct labour (Rs.)	Ranking
A	Rs. 9.00	Rs. 6.00	Rs. 3.00	1.50	1
B	5.50	4.00	1.50	1.00	3
C	7.50	6.00	1.50	1.50	2

Direct labour available expressed in value will be utilized as under

	Sales units	D. Labour p.u.	Total labour available
A	30,000	Rs. 2.00	Rs. 60,000
C	7,000	1.00	7,000
B	42,000*	1.50	63,000
			(balance)

*Rs. 63,000 ÷ Rs. 1.50 = 42,000 units

Now the sales forecast II can be easily worked out.

Products	Sales units	S.P.p.u.	Sales Value
A	30,000	Rs. 9.00	Rs. 2,70,000
B	42,000	5.50	2,31,000
C	7,000	7.50	52,500

(iii)

Product	S.P. Units	V. Cost:	Contri- bution p.u.	Sales units	Total contribution
A	Rs. 10.00	Rs. 6.00	Rs. 4.00	22,000	Rs. 88,000
B	6.00	4.00	2.00	40,000	80,000
C	7.50	6.00	1.50	6,000	9,000
Total Contribution					<u>1,77,000</u>
Less : Fixed overheads					<u>1,00,000</u>
Profit					<u>77,000</u>

Forecast II

Products	Contribution p.u.	Sales Units	Total contribution
A	Rs. 3.00	30,000	Rs. 90,000
B	1.50	42,000	63,000
C	1.50	7,000	10,500
Total contribution			<u>1,63,500</u>
Less: fixed overheads			<u>1,00,000</u>
			<u>63,500</u>

Problem 238. (Apportionment of Joint Costs). Three joint products are produced by passing chemicals through two consecutive processes.

Output from process I is transferred to process 2 from which the three joint products are produced and immediately sold. The data regarding the processes of April, 1990 is given below :-

	Process I	Process 2
Direct material 2500 kilos at Rs. 4 per kilo	Rs. 10,000	---
Direct labour	Rs. 6,250	Rs. 6,900
Overheads	Rs. 4,500	Rs. 6,900
Normal loss	10% of input	Nil
Scrap value of loss	Rs. 2 per kilo	---
Output	2300 kilos	Joint products A-900 Kilos B 800 Kilos C-600 Kilos

There were no opening or closing stocks in either process and the selling prices of the output from process 2 were :

Joint Product A	Rs. 24 per kilo
Joint Product B	Rs. 18 per kilo
Joint product C	Rs. 12 per kilo

Required :

- Prepare an account for process 1 together with any Loss or Gain Accounts you consider necessary to record the month's activities.
- Calculate the profit attributable to each of the joint products by apportioning the total costs from process 2 :
 - According to weight of output ;
 - By the market value of production.

Solution.

Process I Account

Particulars (Kg.)	Qty. (Ks.)	Rate (Rs.)	Amount	Particulars (Kgs)	Qty (Rs.)	Rate (Rs.)	Amount
To Direct material	2,500	4	10,000	By Process II A/c	2,300	9*	20,700
" Direct labour			6,250	" Normal loss	250	2	500
" Overheads			4,500				
" Abnormal gain	50	9	450				
	2,550		21,200		2,550		21,200

*(Rs. 10,000 + Rs. 6,250 + Rs. 4,500 - Rs. 500) ÷ (2,500 kgs - 250 kgs) = Rs. 9

Normal Loss Account

To Process I A/c	250	2	500	By Sales	200	2	400
				" Abnormal gain A/c	50	2	100
	250		500		250		500

Abnormal Gain Account

To Normal loss A/c	50	2	100	By Process A/c	50	9	450
" Costing P & L A/c			350				
	50		450		50		450

(b) Statement showing the calculation of profit when joint costs are apportioned on weight basis and market value basis.

Joint Output Products	Kg.	S.P. per unit Rs.	Sales Value Rs.	J.C. apportioned on weight Rs.	Profit (Loss) Rs.	J.C. apportioned on value basis Rs.	Profit Rs.
A	900	24	21,600	13,500*	8,100	17,250	4,350
B	800	18	14,400	12,000	2,400	11,500	2,900
C	600	12	7,200	9,000	(1,800)	5,750	1,450
	2,300		43,200	34,500	8,700	34,500	8,700

Joint cost = Rs. 20,700 (from process I) + Rs. 6,900 + Rs. 6,900 = Rs. 34,500

*Joint Product	Output	J.C. apportioned on weight basis	Sales value as per above table	Apportionment *
A	900	$34,500 \times 9/23 = 13,500$	21,600	$34,500 \times 3/6 = 17,250$
B	800	$34,500 \times 8/23 = 12,000$	14,400	$34,500 \times 2/6 = 11,500$
C	600	$34,500 \times 6/23 = 9,000$	7,200	$34,500 \times 1/6 = 5,750$
	2,300	34,500	43,200	34,500

Problem 239. (Transport Costing.) Prakash Automobiles distributes its goods to a regional dealer using a single Lorry. The dealer's premises are 40 kilometres away by road. The Lorry has a capacity of 10 tonnes and makes the journey twice a day fully loaded on the outward journeys and empty on return journeys. The following information is available for a *Four Weekly Period* during the year 1990 :-

Petrol consumption	8 kilometres per litre
Petrol cost	Rs. 13 per litre
Oil	Rs. 100 per week
Drivers wages	Rs. 400 per week
Repairs	Rs. 100 per week
Garage rent	Rs. 150 per week
Cost of Lorry (Excluding Tyres)	Rs. 4,50,000
Life of Lorry	80,000 Kilometres
Insurance	Rs. 6,500 per annum
Cost of Tyres	Rs. 6,250
Life of Tyres	25,000 kilometres
Estimated sale value of Lorry at end of its life	Rs. 50,000
Vehicle Licence cost	Rs. 1,300 per annum
Other overhead cost	Rs. 41,600 per annum

The Lorry operates on a five-day week.

Required :

- (a) A statement to show the total cost of operating the vehicle for the *four weekly period* analysed into running costs and fixed costs.
 (b) Calculate the vehicle cost per kilometre and per tonne kilometre.

Solution:

(a) Before computing the total cost, it is necessary to find out the basic data as under :

1. $\left. \begin{array}{l} \text{Distance travelled} \\ \text{in 4 week period} \end{array} \right\} 40 \text{ km one way} \times 2 \text{ (return)} \times 2 \text{ trips} \times 5 \text{ days} \times 4 \text{ week}$
 $= 3200 \text{ km.}$
2. *For Tonne-km. working* = Empty on return and as such for Tonne-km = $3,200 + 2 = 1600$
3. *Total consumption in 4 weeks* = $3,200 \text{ km} \div 8 \text{ km/ltr} = 400 \text{ Ltr.}$
4. *Tyre Cost* = $(\text{Rs. } 6,250 \div 25,000 \text{ km}) \times 3,200 \text{ km} = \text{Rs. } 800$
5. $\left. \begin{array}{l} \text{Depreciation of Lorry} \\ \text{in 4 weeks} \end{array} \right\} \left(\frac{\text{Rs. } 4,50,000 - 50,000}{80,000} \right) \text{ km} \times 3,200 = \text{Rs. } 16,000$

Operating cost Statement of a Lorry of M/s. Parkash Automobile
(for the 4 week period)

Running Costs

Cost of petrol (400 litres \times Rs. 13)	Rs. 5,200
Oil (Rs. 100 per week \times 4)	400
Driver's wages (Rs. 400 per week \times 4)	1,600
Repairs (Rs. 100 \times 4)	400
Cost of tyres (as at 4 above)	800
Depreciation (as at 5 above)	16,000
Total running cost – (i)	24,400

Fixed Costs

Garage rent (Rs. 150 \times 4)	600
Insurance (Rs. 6500 \div 52) \times 4	500
Licence cost (Rs. 1,300 \div 52) \times 4	100
Other overheads (Rs. 41,600 \div 52) \times 4	3,200
Total fixed cost – (ii)	4,400
Total cost (i) + (ii)	28,800

- (b) Cost per km = $\text{Rs. } 28,800 \div 3,200 = \text{Rs. } 9.00$

Cost per Tonne - Km = $\text{Rs. } 28,800 \div (1600 \times 10 \text{ Tonne}) = \text{Rs. } 1.80$

Problem 240. (Computation of ratio of revised mix of raw materials.) Raw materials 'X' costing Rs. 100 per kilogram and 'Y' costing Rs. 60 per kilogram are mixed in equal proportions for making product 'A'. The loss of materials in processing works out to 25% of the output. The production expenses are allocated at 50% of direct material cost. The end product is priced with a margin of $33\frac{1}{3}\%$ over the total cost. Material 'Y' is not easily available and substitute raw material 'Z' has been found for 'Y' costing Rs. 50 per kilogram. It is required to keep the proportion of this substitute material in

the mixture as low as possible and at the same time maintain the selling price of the end product at existing levels and ensure the same quantum of profit as at present.

You are required to compute what should be the ratio of mix of the raw materials X and Z.

Solution:

It is given that both the raw materials are mixed in *equal proportion, i.e.,* in the ratio of 50:50. Processing loss is 25% of output.

Suppose the output of final product A	=	1
Loss on output	=	25%
Input of materials X and Y	=	1.25 kg
Input of material X (50%)	=	0.625 kg
Input of material Y (50%)	=	0.625 kg.

Cost sheet of 1 kg. of Product A

Materials

X—(0.625 kg × Rs. 100)	Rs. 62.50
Y—(0.625 kg × Rs. 60)	37.50
	<hr/>
Total material cost	100.00
Production Expenses (50% of above)	50.00
	<hr/>
Total cost	150.00
Profit (33-1/3% of total cost)	50.00
	<hr/>
Selling price	200.00

Ratio of mix of the raw materials X and Z

Suppose minimum quantity of material Z in product 'A' is x Kg. The quantity of material X will be $1.25 \text{ kg} - x$ for producing 1 kg. of product A. In order to maintain same level of profit and selling price as shown in the above working, it has to be ensured that total raw materials cost should not exceed Rs. 100. Thus the new equation will be :

$$(x \text{ kg} \times \text{Rs. } 50) + (1.25 \text{ kg} - x) \times \text{Rs. } 100 = \text{Rs. } 100$$

or $x = 0.5 \text{ Kg}$ i.e. quantity of Material Z is 0.5 kg.

Hence quantity of X = $1.25 \text{ kg} - 0.5 = 0.75 \text{ kg}$.

Proportion of materials X and Z = $0.75 : 0.50$ or 3:2.

Problem 241. (Accounting for Shortages/discrepancies). After the annual stock taking you come to know of some significant discrepancies between book stock and physical stock. You gather the following information :

Item	Stock Card Units	Stores Ledger Units	Physical Check Units	Cost/units Rs.
A	600	600	560	60
B	380	380	385	40
C	750	780	720	10

(a) What action should be taken to record the information shown above.

(b) Suggest reasons for the shortage and discrepancies disclosed above and recommend a possible course of action by management to prevent future losses.

(Your answer should be in points and you need not elaborate).

Solution.

(a) For recording the information shown in the problem under consideration, the following action may be taken :

- (i) Check the stock card and stores ledger. The correct physical quantity should be recorded.
- (ii) Investigate reasons for stock losses or surpluses.
- (iii) After ascertaining the reasons for stock losses the following treatment may be followed :
 - (a) Debit Factory Overhead A/c
Credit Stores Ledger Control A/c
(If the shortage is considered as normal loss)
 - (b) Debit Costing P & L A/c
Credit Stores Ledger Control A/c
(If the shortage is considered as abnormal)
 - (c) Debit Work-in-Progress A/c
Credit Stores Ledger Control A/c
(If the shortage is due to non-recording or short recording etc.)
- (iv) Rectification entry may be passed for clerical errors.
- (v) After ascertaining the reason for stock surpluses an appropriate action may be taken as follows :
 - (a) Debit Stores Ledger A/c
Credit Factory Overhead A/c
(If the excess of stock is due to normal causes)
 - (b) Debit Stores Ledger Control A/c
Credit Costing P & L A/c
(If the excess at stock is due to abnormal causes)
 - (c) Debit Stores Ledger Control A/c
Credit Work-in-progress A/c
(If the excess of stock is due to wrong recording etc.)
- (vi) In the given example, the losses are with reference to items A (Rs. 60×40 units = Rs. 2,400 and C (Rs. 10×60) = Rs. 600). As the reasons for these losses are not given, they may be debited to P&L A/c and Stores Ledger Control A/c be credited accordingly.
- (vii) The gains are in respect of stock item B (Rs. 40×5 = Rs. 200). For treating gain of Rs. 200, Stores Ledger Control A/c be debited and Costing P&L A/c be credited.
- (b) Reason for the shortage and discrepancies :-
 - (i) Wastage of material due to spoilage, evaporation etc. which may be normal or abnormal.

- (ii) Components issued for production without entry on stock card and/or stores ledger.
- (iii) Stores staff wrongly reading figures on the requisitions.
- (iv) Theft of stock from stores.
- (v) Clerical errors in stores ledger.

Recommended Course of action to prevent future losses

- (i) Entry in the stores should be restricted to authorised persons only.
- (ii) All issues of stock should be against proper stock requisition slip.
- (iii) Stores should follow a system of internal check for all items of stock.
- (iv) Proper accounting be done for all stock movements.
- (v) Recording of entries in stores ledger and stock card should be made carefully.
- (vi) Stock items which come first in the stores should be issued first to avoid losses due to deterioration or obsolescence.

Problem 242. (Halsey/Rowan Systems of Wage Payment).

- (a) Bonus paid under the Halsey Plan with bonus at 50% for the time saved equals the bonus paid under the Rowan System. When will this statement hold good? (Your answer should contain the proof).
- (b) The time allowed for a job is 8 hours. The hourly rate is Rs. 8. Prepare a statement showing :
- (i) The bonus earned
 - (ii) The total earnings of labour and
 - (iii) Hourly earnings.

Under the Halsey System with 50% bonus for time saved and Rowan System for each hour saved progressively.

Solution:

(a) Bonus under Halsey Plan	Bonus under Rowan Plan
$\text{Std. wage rate} \times \frac{50}{100} \times \text{Time saved}$	$\text{Std. wage rate} \times \frac{\text{Time saved}}{\text{Time allowed}} \times \text{Time taken}$

Bonus under Halsey Plan will be equal to the bonus under Rowan Plan under the following conditions :

$$\text{Std. W.R.} \times (50/100) \times \text{Time saved} = \text{Std. W.R.} \times \frac{(\text{Time Saved})}{\text{Time Allowed} \times \text{Time Taken}}$$

$$\text{or } 1/2 = \text{Time Taken/Time Allowed or Time Taken} = 1/2 \text{ Time Allowed}$$

Thus, when time taken is equal to 50% of time allowed, the bonus under Halsey and Rowan Plans is equal.

(b) In part (b) (iii) of the question, it is required to work out hourly earnings under Halsey System with 50% bonus for time saved and Rowan System for each hour saved progressively. Time allowed for a job is 8 hours and thus time taken will be 8, 7, 6 1. Students should particularly note the language of this question carefully.

**Statement showing Bonus, Total Earnings of Labour and
Hourly Earnings under Halsey and Rowan Schemes**

Time allow-	Time taken	Time saved	Basic wages col. 2 × Rs. 8	Bonus under		Total earning under		Hourly earnings under	
				Halsey (col. 4 × 50%) Col. 3 × 8)	Rowan (col. 2 × Col. 3 × 8)	Halsey (col. 4 + col. 5) Col. 1 × 8)	Rowan (col. 4 + col. 6) Col. 1 × 8)	Halsey (col. 7 + col. 2) Col. 1 × 8)	Rowan (col. 8 + col. 2) Col. 1 × 8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
			Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
8	8	—	64	—	—	64	64	8.00	8.00
8	7	1	56	4	7	60	63	8.57	9.00
8	6	2	48	8	12	56	60	9.33	10.00
8	5	3	40	12	15	52	55	10.40	11.00
8	4	4	32	16	16	48	48	12.00	12.00
8	3	5	24	20	15	44	39	14.67	13.00
8	2	6	16	24	12	40	28	20.00	14.00
8	1	7	8	28	7	36	15	36.00	15.00

I.C.W.A. Inter June 1991

Problem 243. (Labour Cost) 'A', an employee of XYZ Co. gets the following emoluments and benefits.

- | | |
|-----------------------------------------------|------------------------|
| (a) Salary | Rs. 250 per month |
| (b) Dearness Allowance | |
| on 1st Rs. 100 of Salary | Rs. 400 |
| on next Rs. 100 of Salary | Rs. 100 |
| on balance every Rs. 100 | Rs. 50 or part thereof |
| (c) Employers' Contribution to Provident Fund | 8% of Salary and D.A. |
| E.S.I. | 4% of Salary and D.A. |
| (d) Bonus | 20% of Salary and D.A. |
| (e) Other Allowances | Rs. 2,725 per annum. |

A works for 2,400 hours per annum, out of which 400 hours are non-productive but treated as normal idle time. A worked for 18 effective hours in Job No. 15, where the cost of direct materials equals 'A's earnings and the overhead applied is 100% of Prime Cost. The sale value of the job is quoted to earn a profit of 10% on such value.

You are requested to find out :

- (a) Effective hourly cost of 'A' and
(b) The expected sale value of Job No. 15.

Solution:

- | | | |
|-----------------------------|---------|-------------------|
| (a) A's earnings | | Rs. 250 per month |
| 1. Salary | | |
| 2. D.A. : | | |
| on first Rs. 100 of salary | Rs. 400 | |
| on next Rs. 100 of salary | 100 | |
| on balance Rs. 50 of salary | 25 | |
| | <hr/> | 525 per month |
| 3. Total (Salary + D.A.) | | 775 per month |
| 4. Annual salary + D.A. | | 9,300 p.a. |

5. Employers' contribution to P.F. (8% of 4)	744	
6. Employers' contribution to ESI (4% of 4)	372	
7. Bonus @ 20% of item 4	1,860	
8. Other allowances	2,725	
9. Total yearly earnings	15,001	p.a.
10. Annual working hours	2,400	
11. Less: normal idle time	400	
12. Effective annual working hours	2,000	
13. Effective hourly cost of employee "A" $(15,000 \div 2,000) = \text{Rs. } 7.50$ p.h.		

(b) Statement showing effective sale value of job No. 15

Direct labour cost (Rs. 7.50 x 18 hrs.)	Rs. 135
Direct materials	135
Prime cost	270
Overheads (100% of prime cost)	270
Total cost	540
Profit (10% of sale value or 1/9th of cost)	60
Sale value	600

Problem 244. (Use of Equivalent concepts in spoilage).

Following costs were incurred in producing 800 M.T. of M.S. Rods :

Materials	Rs. 2,80,000
Labour	Rs. 1,00,000
Processing Charges	Rs. 1,00,000
Total Cost	Rs. 4,80,000

Of the total output 10% was defective and had to be sold after a discount of 10% off the normal price. The scrap arising out of the production realised a sum of Rs. 8,760. The sale price is calculated to yield 15% profit on sales. You are requested to find out the normal price as well as the discounted price of per M.T. of M.S. Rods.

Statement showing the price per M.T. of M.S. Rods

Materials	Rs. 2,80,000	
Labour	1,00,000	
Processing charges	1,00,000	
Total cost	4,80,000	
Less: Sale value of scrap	8,760	
Net cost of production	4,71,240	
Profit (15% of sales or 15/85 of cost)	83,160	
Total sales Value	5,54,400	
Good units sold (See Working note)	792	M.T.
Price per M.T. (Rs. 5,54,400 ÷ 792)	Rs. 700	/M.T.
Discounted price per M.T. (90% of above)	Rs. 630	/M.T.

Working Note**Equivalent Good Units Sold**

Total production	800 M.T.
Less: Defective production (10%)	80
Good production	720
Add: Equivalent of defective production (90% of 80 M.T)	72
Equivalent good units sold	792 M.T.

For question on overhead absorption rate please refer to Problem 3-3.

Problem 245. (Cost Book-keeping—Treatment of shortages/ discrepancies) In the course of physical verification of stores as on 31st March, 1991, following differences are revealed in case of AB Ltd.

Balance					
Material	Unit	Rate (Rs.)	Physical	Ledger	Remarks
A	Nos.	7.00	600	680	Wrong counting.
B	Litres	12.00	1100	1155	Normal evaporation loss.
C	Nos.	6.00	350	400	Material issues not accounted for.
D	Kgs.	22.00	900	930	Shortage due to pilferage and theft.
E	Nos.	15.00	1475	1325	150 nos. received but not entered in ledger.
F	Metres	10.00	291	291	Obsolete materials. Realised sale value Rs. 1650, awaiting despatch

Prepare journal entries in the Cost Ledger to give effect to the above adjustments as called for.

Solution :

Material A : No journal entry is required. The stock sheet or bin card should be corrected to 680 nos. as the same has already been correctly recorded in the ledger.

		Rs.	Rs.
Material B :	Production overhead control A/c.	Dr. 660	
	To stock control A/c		660
	(Being adjustment for normal loss due to evaporation charged to production overhead)		

Material C :	W.I.P. A/c	Dr. 300	
	To Stock control A/c.		300
	(Being adjustment for 10 nos. of material C not accounted for)		

Material D :	Profit & Loss A/c	Dr.	660	
	To Stock control A/c			660
	(Being adjustment for abnormal loss of 30 kgs of material D due to pilferage and theft)			
Material E :	Stock Control A/c.	Dr.	2,250	
	To General Ledger A/c			2,250
	(Being entry for material received but not taken into stock)			
Material F :	General Ledger A/c	Dr.	1,650	
	Profit & Loan A/c.	Dr.	1,260 *	
	To Stock ledger control A/c			2,910
	(Being the entry to write off obsolete stores).			

(For question on evaluation of various proposals for utilization of idle capacity, please refer to Problem 10.57.)

Problem 246. (Equivalent concept—Determining the values of WIP and Finished Products). A manufacturing concern produces standardised electric meters in one of its departments. From the following particulars relating to a job of 50 meters, you are required to determine the value of the work-in-progress and the finished goods. •

(a) Costs incurred as per job card :

Direct materials :	Rs. 7,500
Direct Labour :	Rs. 2,000
Overheads :	Rs. 6,000

(b) Selling price per meter

Rs. 450

(c) Selling and distribution expenses: 30% of the sale value.

(d) 25 meters are completed and transferred to the stock of finished goods.

(e) Completion stage of work-in progress :

Direct materials:	100%
Direct Labour :	60%
Overheads:	60%

Solution.

Statement of equivalent production and cost per equivalent units

Particulars	Output (Units)	Equivalent Production				Total
		D.M.		D.L. & Ohds.		
		Units	%	Units	%	
Finished Goods	25	25	100	25	100	15,500
Work-in-progress	25	25	100	15	60	
Total (Equivalent production)	50	50		40		
Total cost (Rs.)		7500		8,000		
Cost per Meter (Rs.)		150		200		

* It is presumed that these obsolescence is of abnormal nature.

From the above statement, it is observed that the actual cost of production per meter is Rs. 350. As the finished stock is valued at cost or market value whichever is lower, it necessary to work out the market value of the product as indicated below :

Selling price per meter	Rs. 450
Less: Selling and distribution expenses (30% of Rs. 450)	135
Market value of finished product	<u>315</u>

As the market value is lower than cost, the finished goods are to be value at market price.

Market value of 25 meters	25 × Rs. 315 = Rs. 7,875.
Value of work-in-progress	
Direct materials	25 × Rs. 150 Rs. 3,750
Direct labour and overheads	15 × Rs. 200 3,000
	<u>6,750</u>

[For question on normal abnormal loss/gain, please refer to Problem 6.1.]

Problem 247 (Reconciliation). (a) State the reasons for the difference between the profits shown in the cost accounts and those shown in the financial accounts of an industrial organisation.

(b) From the following figures prepare a statement reconciling the profits as per the cost accounts and the profits as per the financial accounts.

Net profit as per the financial accounts	Rs. 1,28,755
Net profit as per the cost accounts	1,72,400
Works overheads under-recovered	3,120
Administrative overheads over-recovered	1,700
Depreciation charged in the financial accounts	11,200
Dereciation charged in the cost accounts	12,500
Interest received but not included in the cost accounts	8,000
Loss due to obsolescence charged in the financial accounts	5,700
Income-tax provided in the financial accounts	40,300
Stores adjustment credited in the financial accounts	475
Depreciation of stock charged in the financial accounts	6,750
Bank interest credited in the financial accounts	750

Solution :

(a) Please refer to Textbook on Cost Accounting by V.K. Saxena and C.D. Vashist.

(b) Statement showing reconciliation of cost accounts with financial accounts.

Net Profit as per Cost Accounts.	Rs. 1,72,400
Less: Works overhead under recovered	Rs. 3,120

Loss due to obsolescence charged in financial accounts	5,700	
Income tax provided in financial accounts	40,300	
Depreciation on stock charged in financial accounts	6,750	55,870
		<hr/>
		1,16,530
<i>Add:</i> Administrative overhead over recovered	1,700	
Excess depreciation charged in cost accounts (Rs. 12,500 – 11,200)	1,300	
Interest received but not considered in cost accounts	8,000	
Store adjustment <i>credited</i> in financial accounts	475	
Bank interest credited in financial accounts	750	12,225
		<hr/>
Net profit as per financial accounts		1,28,755
		<hr/>

[For question on B.E. Analysis, please refer to Problem A 69]

[For question on material variances, please refer to Problem A 68]

Problem 248. (Transport Costing). The 'Kangaroo Transport Ltd.' operates a fleet of lorries. The records for lorry L-14, reveal the following information for September 1990 :

Days maintained	30	
Days operated	25	
Days idle	5	
Total hours operated	300	
Total Kms. covered	2,500	
Total tonnage carried	200	(4 tonne-load per trip return journey empty)

The following further information is made available :

- A. Operating Costs for the month :
Petrol Rs. 400/-, Oil Rs. 170/-, Grease Rs. 90/-, Wages to driver Rs. 550/-, Wages to Khalasi Rs. 350/-.
- B. Maintenance Costs for the month:
Repairs Rs. 170/-, Overhaul Rs. 60/-, Tyres Rs. 150/-, Garage charges Rs. 100/-.
- C. Fixed Cost for the month based on the estimates for the year :
Insurance Rs. 50/-, Licence, tax etc. Rs. 80/-, Interest Rs. 40/-, other overhead Rs. 190/-.
- D. Capital Costs:
Cost of acquisition Rs. 54,000/-.
Residual value at the end of 5 years life is Rs. 36,000/-.

Prepare a Cost sheet and Performance statement showing :

- (a) Cost per day maintained ;
- (b) Cost per day operated ;
- (c) Cost per kilometer ;

- (d) Cost per hour ;
 (e) Cost per commercial tonne-kms. (I.C.W.A. Inter December 1990)

**Cost Sheet of M/s. Kangaroo Transport Ltd.
 for the month Sept., 1990**

<i>Details</i>		<i>Amount Rs.</i>
Operating Costs :		
Petrol	Rs. 400	
Oil	170	
Grease	90	
Wages to driver	550	
Wages to Khalasi	350	
	<hr/>	
Total operating costs		1,560
Maintenance Costs :		
Repairs	Rs. 170	
Overhaul	60	
Tyre	150	
Garage charges	100	
	<hr/>	
Total maintenance costs		480
Fixed costs :		
Insurance	Rs 50	
Licence tax	80	
Interest	40	
Other Overheads	190	
Depreciation $\frac{(Rs. 54,000 - Rs. 36,000)}{5 \times 12}$	300	
	<hr/>	
Total fixed costs		660
Total monthly costs		<u>2,700</u>

Performance data

Commercial Tonne-Kms p.m. = 50 km. \times 4 tonne \times 25 day =	5,000
Days maintained	30
Days operated	25
Days idle	5
Total hours operated	300
Total Km. covered	2,500
Total trip	50
(a) Cost per day maintained (Rs. 2,700 \div 30 days)	Rs. 90
(b) Cost per day operated (Rs. 2,700 \div 25)	108
(c) Cost per kilometre	
Total cost \div Total km. covered (Rs. 2700 \div 2500)	= Re. 1.08
(d) Cost per hour	
Rs. 2,700 \div 300	Rs. 9.00
(e) Cost per commercial tonne-km. (Rs. 2700 \div 5000)	= Re. 0.54

C.S. Inter June 1991

[For question on most profitable product-mix, please refer to Problem 9.53
(Figures reduced to half)]

Problem 249. (Equivalent Production) Attractive & Co. operates a department producing a component which passes through two processes. During November, 1990 materials for 40,000 components were put into process. There was no opening process stock. 30,000 components were finished and passed to next process. Those not passed forward were calculated to be one-half finished as regards wages and overhead. The cost incurred were as follows :

Direct material	Rs. 10,000
Direct wages	8,000
Factory overhead	12,000

Of those passed to the second process, 28,000 were completed and passed finished stores. 200 were scrapped, which was not abnormal. 1,800 remained unfinished in process, one-quarter finished as regards wages and overhead. No further process materials costs occur after introduction at the first process until the end of the second process, when protective packing is applied to the completed components. The process and packing costs incurred at the end of the second process were :

Direct material (Packing)	Rs. 4,000
Direct wages	3,500
Factory overhead	4,500

Prepare a cost analysis statement for November, 1990 accounting for total costs incurred, analysed into elements of costs for process, covering finished and part-finished items and process accounts.

Solution.

Process I

Statement of Equivalent Production

Input	Particulars	Output (Units)	Material		Labour & Ohd.	
			Units	%	Units	%
---	O/stock					
40,000	Introduced					
	Completed	30,000	30,000	100	30,000	100
	C/stock	10,000	10,000	100	5,000	50
40,000		40,000	40,000		35,000	

Statement of Cost of each element

Element of Cost	Total Cost	Equivalent Units	Cost per unit
Direct material	Rs. 10,000	40,000	Re. 0.2500
Direct wages	8,000	35,000	0.2286
Factory overhead	12,000	35,000	0.3428
	30,000		

Statement of apportionment of Cost

Particulars	Element of cost	Equivalent Production	Cost per unit Re.	Cost Rs.	Total Cost Rs.
Units completed	Material	30,000	0.25	7,500	
	Labour	30,000	0.2286	6,858	
	Overhead	30,000	0.3428	10,284	24,642
Closing Stock	Material	10,000	0.25	2,500	
	Labour	5,000	0.2286	1,144	
	Overhead	5,000	0.3428	1,714	5,358
					<u>30,000</u>

Process II

Input (Units)	Particulars	Output (Units)	Material		Labour & Ohd.	
			(Units)	%	Units	%
30,000	O/Stock					
	Transfer from Process I					
	Completed	28,000	28,000	100	28,000	100
	Normal Loss	200	---	---		
	C/stock	1,800	1,800	100	450	25
30,000		30,000	29,800		28,450	

Statement of Cost of each element

Element of Cost	Total Cost	Equivalent units	Cost per unit
Cost from Process I	Rs. 24,642	29,800	Rs. 0.8269
Direct material	3,500	28,450	0.1230
Direct wages	4,500	28,450	0.1582
Factory overhead	32,642		
Add : packing cost	4,000	28,000	0.143
	36,642		
Less: W.I.P.	1,615		
Finished stock	35,027		

Statement of apportionment of Cost

Particulars	Element of Cost	Equivalent production	Cost per unit Rs.	Cost Rs.	Total cost Rs.
Units completed	Material	28,000	0.8269	23,153	
	Labour	28,000	0.1430	3,444	
	Overhead	28,000	0.1582	4,430	31,027
Closing Stock	Material	1,800	0.8269	1,489	
	Labour	450	0.1230	55	
	Overhead	450	0.1582	71	1,615
					<u>32,642</u>

* Rs. 4,000 represents packing cost. This cost is incurred on completion of units at the end of Process II. Completed units are then transferred to finished stock. This cost is, thus, charged to finished stock.

Process I Account

Particulars	Units	Amount	Particulars	Units	Amount
To Direct material	40,000	Rs. 10,000	By transfer to Process II	30,000	24,642
" Direct wages		8,000	" Work in progress	10,000	5,358
" Overhead		12,000			
	40,000	30,000		40,000	30,000

Process II Account

To Process I	30,000	24,642	By finished stock	28,000	35,027
" Direct wages		3,500	" Normal loss	200	---
" Overhead		4,500	" W.I.P.	1,800	1,615
" Packing material		4,000			
	30,000	36,642		30,000	36,642

Problem 250. (EOQ) Pumpkin Pump Co. uses about 75,000 valves per year and the usage is fairly constant at 6,250 valves per month. The valves cost Rs. 1.50 per unit when bought in quantities and the carrying cost is estimated to be 20% of average inventory investment on the annual basis. The cost to place an order and process the delivery is Rs. 18. It takes 45 days to receive delivery from the date of an order and a safety stock of 3,200 valves is desired.

You are required to determine.

- the most economical order quantity and frequency of orders ; and
- the order point ;

(b) (BE Analysis) The profit volume (P/V) ratio BB & Co. dealing in precision instruments is 50% and the margin of safety is 40%.

You are required to work out the break-even point and the net profit if the sale volume is Rs. 50 lakhs.

Solution.

$$(a) (i) \text{EOQ} = \sqrt{\frac{2 \times \text{Annual consumption} \times \text{Buying cost per order}}{\text{Cost per unit} \times \text{Storage and carrying cost rate.}}}$$

$$= \sqrt{\frac{2 \times 75,000 \times 18}{\text{Rs. } 1.50 \times 20\%}} = 3000 \text{ units}$$

(ii) Calculation of order point

$$= \text{Safety stock} + \text{Lead time consumption}$$

$$= 3,200 + (1.5 \text{ months} \times 6250 \text{ units p.m.})$$

$$= 12,575 \text{ units}$$

(b) Sales = 50 lakhs P/V Ratio = 50% Margin of safety = 40%

Less margin

of safety 20 "

At B.E. Sales contribution is just sufficient to meet fixed cost

B.E. Sales

30 "

Fixed cost = BES \times P/V Ratio

$$= 30,00,000 \times 50\% = \text{Rs. } 15,00,000$$

Net profit at Rs. 50,00,000 sales level

Sales	=	Rs. 50,00,000
Less variable cost (50%)		<u>25,00,000</u>
Contribution		25,00,000
Fixed cost		<u>15,00,000</u>
Net profit		10,00,000

Problem 251. (Cost Sheet). A company has two manufacturing shops. The shopfloor supervisor presented the following cost for job no. A to determine the selling price :

	(Rs. per unit,
Material	70
Direct wages 14 hrs. @ Rs. 2.50 per hour (Deptt. X 8 hrs.; and Deptt. Y-6 hrs.)	35
Chargeable expenses (stores)	<u>5</u>
	110
Add: 33-1/3% for expenses (overheads)	<u>37</u>
	<u>147</u>

Analysis of the profit and loss account shows the following:

Material used	Rs. 1,50,000	Sales less returns	Rs. 2,50,000
Direct wages :			
Deptt. X	10,000		
Deptt. Y	<u>12,000</u>		
	22,000		
Stores expenses	<u>4,000</u>		
Overheads :			
Deptt. X	5,000		
Deptt. Y	<u>9,000</u>		
	14,000		
	<u>1,90,000</u>		
Gross profit c/d	60,000		
	<u>2,50,000</u>		
			<u>2,50,000</u>

It is noted that average hourly rates for the two departments X and Y are similar.

You are required to draw a job cost sheet using overheads figures as shown in the profit and loss account as the basis for charging overheads to Deptt. X and Y after adding 20% of the total costs to determine selling price.

Solution : Before drawing the cost sheet, the overhead recovery rates for Departments X and Y have to be determined as under :

	Deptt. X	Deptt. Y
Direct wages	Rs. 10,000	Rs. 12,000
Overheads	5,000	9,000
Overheads as a % of D.W.	50%	75%

Job Cost Sheet

<i>Particulars</i>	<i>Hours</i>	<i>Rate per hr.</i>	<i>Amount</i>
Material			Rs. 70.00
Direct wages :			
Deptt. X	8	2.50	20.00
Deptt. Y	6	2.50	15.00
Chargeable expenses			5.00*
Prime Cost*			110.00
Overhead :			
Deptt. X (50% of D.W.)			10.00
Deptt. Y (75% of D.W.)			11.25
Total cost			131.25
Profit (20% of total cost)			26.25
Selling price			157.50

C.A. Final May 1991.

Problem 252. (Accepting an offer—Relevant Cost Concept) A company has been making a machine to order for a customer, but the customer has since gone into liquidation, and there is no prospect that any money will be obtained from the winding up of the company.

Costs incurred to-date in manufacturing the machine are Rs. 50,000 and progress payments of Rs. 15,000 have been received from the customer prior to the liquidation.

The sales department has found another company willing to buy the machine for Rs. 34,000 once it has been completed.

To complete the work, the following costs would be incurred :

- Materials—these have been bought at a cost of Rs. 6,000. They have no other use, and if the machine is not finished, they would be sold as scrap for Rs. 2,000.
- Further labour costs would be Rs. 8,000. Labour is in short supply, and if the machine is not finished, the work force would be switched to another job, which would earn Rs. 30,000 in revenue, and incur direct costs (not including direct labour of Rs. 12,000 and absorbed (fixed) overhead of Rs. 8,000.
- Consultancy fees Rs. 4000. If the work is not completed, the consultant's contract would be cancelled at a cost of Rs. 1,500.
- General overheads of Rs. 8,000 would be added to the cost of the additional work.

*Please note the change in the terminology of Prime Cost issued by C.I.M.A. London in Feb., 1991. Now Prime Cost includes only direct material and direct wages.

Should the new customer's offer be accepted ? Prepare a statement showing the economics of the proposition.

Solution.

**Statement showing the economics of the proposition
(only relevant costs considered)**

● Revenue from completing the work		Rs. 34,000
Less: Relevant Cost of :-		
Material (opportunity cost)	Rs. 2,000	
Labour — Cost to be incurred	8,000	
Opportunity cost	10,000	
Incremental cost of consultancy	<u>2,500</u>	<u>22,500</u>
Extra profit to be earned by accepting the offer of new customer to complete the work		<u>11,500</u>

Since the acceptance of offer will yield an extra profit of Rs. 11,500, the offer should be accepted.

Notes : 1. Costs incurred in the past are sunk costs. Revenue received in the past is also not relevant ; because they do not have any bearing on the decision under consideration. For this reason, costs of Rs. 50,000 incurred already and progress payment received already are irrelevant for this decision.

2. Price paid for the material in the past are irrelevant. Revenue of Rs. 2,000 in the form of scrap, which would be foregone, i.e., opportunity cost.

3. Labour Costs—contribution foregone i.e., opportunity cost :

Revenue	Rs. 30,000	
Less : Direct labour Rs. 12,000		
Fixed Cost	<u>8,000</u>	<u>20,000</u>
		10,000

4. Incremental cost of completing the work.

Cost of completing	Rs. 4,000	
Cost of cancellation of the contract	<u>1,500</u>	2,500

5. Absorbed overhead represent allocated costs and should be ignored for the decision.

Problem 253. (Variance Analysis including Control Accounts) Gemini Enterprises manufactures product A. It uses a standard costing system in which material price variance and labour rate variance are segregated at the point of purchase of material and the incurrence of labour cost respectively.

The standard cost card for product A shows the following details :-

	Rs. per unit
Material—2 kgs. at 3 per kg.	6
Labour—5 hrs. at Rs. 2 per hr.	10
Overhead—5 hrs. at Re. 1 per hr.	<u>5</u>
	<u>21</u>

Overhead rate is Re. 1 per hour, the budgeted overhead being Rs. 2,000 for 2,000 budgeted hours.

Other information for a month is as follows :

Materials :

Opening stock 800 kgs. at Rs. 3 per kg.

Purchases 1000 kgs. at Rs. 3.50 per kg.

Issued to production 800 kgs.

Direct labour :

1850 hours at Rs. 2.20 per hour.

Overhead: Rs. 2,100

During this month, 360 units are completed and in respect of 40 units, it is estimated that they are complete as to materials, but half complete as to labour and overhead. 300 units are sold at Rs. 30 per unit during the month. Prepare :

(a) Cost Control Accounts

(b) Variance Accounts

(c) Trial balance at the end of the month

Solution.

Working Notes

Work done in terms of completed units

As regards material— $360 + 40 = 400$ units

As regards labour— $360 + \frac{1}{2} \times 40 = 380$ units

As regards overhead— $360 + \frac{1}{2} \times 40 = 380$ units

(a) *Cost Control Accounts*

Material Control A/c			
To Balance b/d	Rs. 2,400	By W.I. P (800 Kg. \times 3)	Rs. 2,400
" Cost Ledger Control A/c.	3,000	" Material usage variance	
		100 kg. \times Rs. 3	300
		" Balance c/d	2,700
	<u>5,400</u>		<u>5,400</u>
Wages Control A/c			
To Cost Ledger Control A/c.	3,700	By WIP Control A/c	3,800
" Efficiency A/c	100		
	<u>3,800</u>		<u>3,800</u>
Overhead Control A/c			
To Cost Ledger Control A/c.	2,100	By W.I.P. Control A/c	1,900
		" O.H. Exp. Variance	100
		" O.H. Efficiency Variance	100
	<u>2,100</u>		<u>2,100</u>
Work-in-Progress A/c			
To Material Control A/c.	Rs. 2,400	By Finished Goods A/c,	
" Labour Control A/c.		(360 \times 21)	Rs. 7,560
(380 \times 5 \times 2)	3,800	" Balance	
" Overhead control A/c.		40 \times 6 = 240	
(380 \times 5 \times 1)	1,900	20 \times 10 = 200	
		20 \times 5 = 100	540
	<u>8,100</u>		<u>8,100</u>

Finished Goods A/c			
To W.I.P. A/c.	7,560	By Cost of Sales A/c.	
		(300 × 21)	6,300
		" Balance c/d.	1,260
	<u>7,560</u>		<u>7,560</u>

Cost of Goods Sold A/c			
To Finished Goods A/c	6,300	By Costing P & L A/c.	6,300
	Cost Ledger	Control A/c	
To Sales A/c	9,000	By Balance b/d	2,400
" Balance c/d	4,500	" Material control A/c	3,000
		" Material prices A/c	500
		" Wages control A/c	3,700
		" Wages rate variance	370
		" Overhead control A/c	2,100
		" Costing P & L A/c	1,430
	<u>13,500</u>		<u>13,500</u>

Sales

To Costing P & L A/c	9,000	By Cost Ledger Control A/c	Rs. 9,000
		(300 × 30)	

Costing P & L A/c

To Cost of Goods Sold A/c	6,300	By Sales	9,000
" Material price variation A/c	500	" Wage Efficiency	100
" Material usage A/c	300		
" Wage rate variance A/c	370		
" Overhead expenditure A/c	100		
" Overhead efficiency A/c	100		
" Cost Ledger Control A/c			
(Profit)	1,430		
	<u>9,100</u>		<u>9,100</u>

(b) Variance Accounts

Material Price Variance A/c

To Cost Ledger Control A/c.	500	By Costing P & L A/c	500
(M ₁ - M ₂)			

Material Usage Variance

To Material Control A/c	300	By Costing P&L A/c	300
(M ₂ - M ₄)			

Wage Rate Variance

To Cost Ledger Control A/c	370	By Costing P&L A/c.	370
(L ₁ - L ₂)			

Wage Efficiency Variance

To Costing P&L A/c.	100	By Wage Control A/c.	100
		(L ₂ - L ₅)	

Overhead Expenditure Variance

To Overhead Control	100	By Costing P&L A/c.	100
(FO ₁ - FO ₂)			

Overhead Efficiency Variance

To Overhead Control A/c.	100	By Costing P&L A/c.	100
(FO ₂ - FO ₅)			

(c) Trial Balance at the end of the month.

	Dr.	Cr.
Cost Ledger		4,500
Material Control A/c.	2,700	
Work-in-Progress A/c.	540	
Finished Good A/c	1,260	
	<u>4,500</u>	<u>4,500</u>

Notes 1. It is presumed that Single Plan is used by this company.

2. Variance have been worked out as follows :

M_1 — Actual cost of material used 1000 kg. \times Rs. 3.50 = Rs. 3,500

M_2 — (a) Standard cost of material used = 1000 kg. \times Rs. 3.00
= Rs. 3,000

(b) Standard material cost issued to production = 400 units \times
Rs. 6 = 2,400

M_4 — Standard material cost of output = 400 units \times Rs. 6 = 2,400

Material price variance = $M_1 - M_2$ = Rs. 3,500 - 3,000 = 500 (A)

Material usage variance = $M_2 - M_4$ = Rs. 2,700 - 2,400 = 300 (A)

Note that material price variance will be incurred at the time of purchase and material wage variance will be calculated with reference to actual material quantity issued.

L_1 —Actual payment for actual hours worked = 1850 hrs \times 2.20 =
Rs. 4,070

L_2 —Payment involved if the workers had been paid at standard rate
1850 hrs. \times 2 = 3,700

L_3 —Standard labour cost of output achieved 380 \times Rs. 10 = 3,800

Wage Rate Variance = $L_1 - L_2$ = Rs. 4070 - 3700 = 370 (A)

Wage Efficiency Variance = $L_2 - L_3$ = Rs. 3700 - 3800 = Rs. 100 (F)

FO_1 —Actual fixed overhead Rs. 2,100

FO_2 —Budgeted fixed overhead 2,000

FO_5 —Standard fixed overhead for production 1,900

(380 \times 5)

Fixed overhead expenditure variance = $FO_1 - FO_2$ = Rs. 2,100 - Rs. 2000 = 100 (A)

Fixed Overhead Efficiency Variance = $FO_2 - FO_5$ = 2,000 - 1900 = Rs. 100 (A)

C Problem 254. (Change in Cost, Volume and Price). Sterling Enterprises has prepared a draft budget for the next year as follows :-

	10,000 Units	
	Rs.	Rs.
Sale Price Per unit		30
Variable costs per unit :-		
Direct Material	8	
Direct Labour (2 hours \times Rs. 3)	6	
Variable Overhead (2 hours \times Re. 0.50)	1	15
Contribution per unit		<u>15</u>

Budgeted contribution	1,50,000
Budgeted fixed costs	1,40,000
Budgeted Profit	<u>10,000</u>

- The Board of Directors are dissatisfied with this budget, and ask a working party to come up with an alternate budget with a higher profit figures.

The working party reports back with the following suggestions which will lead to a budgeted profit of Rs. 25,000. The company should spend Rs. 28,500 on advertising, and put the sales price up to Rs. 32 per unit. It is expected that sales volume would also rise, in spite of the price increase, to 12,000 units. In order to achieve the extra production capacity, however, the work force must be able to reduce the time taken to make each unit of the product. It is proposed to offer a pay and productivity deal, in which the wage rate per hour is increased to Rs. 4. The hourly rate for variable overhead will be unaffected.

Prepare a revised budget giving effect to the above suggestions.

Solution.

Working Note :- This question is of profit planning i.e., starting from target profit, all other figures will be worked out by working back.

- (i) *The revised target profit will be as follows :*

Target profit		Rs. 25,000
Original budgeted fixed cost	Rs. 1,40,000	
Add: Advertisement cost	<u>28,500</u>	<u>1,68,500</u>
Revised contribution required		<u>1,93,500</u>

- (ii) *Target variable cost.*

Budgeted Sales Revenue $12,000 \times 32$	Rs. 3,84,000
Less: Contribution as per (i)	<u>1,93,500</u>
	<u>1,90,500</u>

- (iii) *Target labour and variable costs will be*

Total variable costs	Rs. 1,90,500
Less : Material cost $(12,000 \times 8)$	<u>96,000</u>
	<u>94,500</u>

- (iv) *Target production time per unit will be :*

Sales units	12,000
Target labour and variable cost per unit	
Rs. $94,500 \div 12,000$	Rs. 7.875
Rate per hour (Rs. 4.00 + Re. 0.50)	Rs. 4.50
Target production time per unit	
= Rs. $7.875 \div \text{Rs. } 4.50$	1.75 hrs.

A time of 1.75 hours per unit will be required to achieve a profit of Rs. 25,000

	Revised Budget
Sales price per unit	Rs. 32
Variable Cost per Unit :	
Material	8.00

Direct labour (1.75 × Rs. 4)	7.00	
Variable overhead (1.75 × 0.50)	0.875	15.875
Contribution per unit		16.125
Budgeted contribution (12,000 × Rs. 16.125)		Rs. 1,93,500
Budgeted fixed costs (Rs. 1,40,000 + 28,500)		1,68,500
Budgeted profit		25,000

Problem 255. (Preparation of original and flexible budget with given variances). A small company, making a single product, produces accounts for a costing period, as followings :-

Direct Material	Rs. 792	Rs.
Direct Wages	1,192	
Variable Overhead	1,940	
Fixed Overhead	1,040	4,964
Profit		976
Sales		5,940

The original budget was in respect of 1,000 units per period, but during this period only 960 units were produced and sold.

Standard direct wage rate is Re. 0.60 per hour and standard variable overhead rate is Re. 1.00 per hour.

Cost variances during the period are as follows :-

	Gains (Rs)	Losses (Rs.)
Material Price	---	8
Material Usage	---	16
Wages Rate	20	---
Labour Efficiency	---	60
Variable Overhead Expenditure	80	---
Variable Overhead Efficiency	---	100
Fixed Overhead Cost	---	40
Sales Price	180	---

From the above information, prepare for the period the original budget and a flexible budget for the sales achieved.

Solution.

Workings :

Statement showing standard cost per unit based on the production of 960 units

	Actual for 960 units	Variances	Standard cost for 960 units	Standard cost per unit
Material	Rs. 792	(-) 24	Rs. 768	Rs. 0.80
Labour	1,192	(-) 40	1,152	1.20
Variable Overhead	1,940	(-) 20	1,920	2.00
Fixed overhead	1,040	(-) 40	1,000	1.04
Total cost	4,964	(-) 124	4,840	5.04
Profit	976	(+) 56*	920	0.96
Sales	5,940	(+) 180	5,760	6.00

* Rs. 180 - 124 = Rs. 56

(-) mean adverse variance ; (+) means favourable variance.

Original Budget and flexed budget for 960 units

	<i>Standard Cost per unit</i>	<i>Original Budget (1000 units)</i>	<i>Flexible (960 units)</i>
Direct material	0.80	800	768
Direct wages	1.20	1,200	1,152
Variable overhead	2.00	2,000	1,920
Fixed overhead	1.04	1,040	1,040
Cost of sales	5.04	5,040	4,880
Profit	0.96	960	880
Sales	6.00	6,000	5,760

Problem 256. (Shut-down or continue). A paint manufacturing company manufactures 2,00,000 per annum medium-sized tins of "Spray Lac Paints" when working at normal capacity. It incurs the following costs of manufacturing per unit.

Direct Material	Rs. 7.80
Direct Labour	2.10
Variable Overhead	2.50
Fixed Overhead	4.00
Product Cost (per unit)	<u>16.40</u>

Each unit (tin) of the product is sold for Rs. 21 with variable selling and administrative expenses of 60 paise per tin.

During the next quarter only 10,000 units can be produced and sold. Management plans to shut down the plant estimating that the fixed manufacturing cost can be reduced to Rs. 74,000 for the quarter.

When the plant is operating, the fixed overheads are incurred at a uniform rate throughout the year. Additional costs of plant shut-down for the quarter are estimated at Rs. 14,000.

You are required :

- To express your opinion, along with the calculations, as to whether the plant should be shut down during the quarter, and
- To calculate the shut down point for quarter in units of products (*i.e.* in terms of number of tins).

Solution (a) Statement showing the net advantage of continuing or shut down of plant based on relevant cost approach

<i>Alternative 1 (Continue)</i>		<i>Alternative 2 (Shut down)</i>	
Sales 10,000 × Rs. 21	2,10,000	Advantage of reduction in fixed cost for the quarter	Rs.
Less: Cost 10,000 × 13*	= 1,30,000	(Rs. 2,00,000@ - 74,000)	= 1,26,000
Incremental contribution due to the decision to continue	<u>80,000</u>	Less : Shut down expenses	<u>14,000</u>
		Net advantage of shut down decision	<u>1,12,000</u>

* 7.80 + 2.10 + 2.50 + 0.60 ; @ Rs. 80,000 ÷ 4

Conclusion: The decision to shut down is more advantageous to the company than the decision to continue. Net advantage of decision to shut

down exceeds the incremental contribution by continuing by Rs. 32,000 i.e., Rs. 1,12,000 – 80,000.

(b) The net advantage of the decision to shut down is Rs. 1,12,000. Company should continue to produce till contribution is more than this point. As soon as total contribution equals Rs. 1,12,000, the shut down point will arrive and decision to continue will start resulting losses. This can be expressed as follows :-

$$\left(\begin{array}{c} \text{Point of shut-down} \\ \text{say } x \text{ units} \end{array} \right) \times \left(\begin{array}{c} \text{Contribution} \\ \text{per unit} \end{array} \right) = \text{Rs. 1,12,000}$$

$$\text{or } x \times (\text{Rs. 21} - \text{Rs. 13}) = \text{Rs. 1,12,000} \quad \text{or } x = 14,000 \text{ units.}$$

I.C.W.A. Final June 1991

Problem 257. (Break-even Analysis). A Pharmaceutical Company produces formulations having a shelf life of one year. The company has an opening stock of 15,000 boxes on 1st January, 1991 and expects to produce 65,000 boxes as was in the just ended year of 1990. Expected sale would be 75,000 boxes.

Costing department has worked out escalation in cost by 25% on variable cost and 10% on fixed cost for the year 1991. Fixed costs are estimated at Rs. 14,30,000. New price announced for 1991 is are estimated at Rs. 14,30,000. New price announced for 1991 is Rs. 50/- per box. Variable cost of the opening stock is Rs. 20 per box.

Required :

- (i) To find out break-even volume for the year 1991, and
- (ii) To estimate the profits that would be realised on the sale during 1991.

Solution. (i) *This question is unique.* The following points should be particularly noted before finding out the B.E. volume for 1991 :

(a) For expected sale of 75,000 boxes during 1991, first of all 15,000 boxes (opening stock) will have to be sold as the shelf life of the formulations is just one year. The remaining sale of 60,000 boxes will be out of the 1991 production.

(b) Variable cost of Rs. 20 has been given in respect of opening stock. By applying the escalation factor of 25%, the same can be found out for 1991 production.

(c) Fixed cost has been estimated at Rs. 14,30,000 for 1991. This includes the increase in fixed cost @ 10% over the previous year. Fixed cost for the previous year can be easily determined.

Now the B.E. volume can be found out. At B.E. sales, contribution is just sufficient to meet fixed cost and there is no element of profit/loss. At B.E. volume, total fixed cost of Rs. 14.30 lakhs will have to be recovered. First of all, it has to be recovered from contribution from sale of opening stock of 15,000 boxes, as computed below.

15,000 boxes × (Rs. 50 – Rs. 20)	= Rs. 4.50 lakhs
Balance fixed cost to be recovered from current sale	9.80 lakhs
Total fixed costs	<u>14.30 lakhs</u>

Variable cost for current production $\text{Rs. } 20 \times 1.25 = \text{Rs. } 25$

Contribution per box $= \text{Rs. } 50 - \text{Rs. } 25 = \text{Rs. } 25$

B.E. volume for current production $= \text{Rs. } 9,80,000 \div \text{Rs. } 25 = 39,200$ boxes.

Total B.E. volume $= 15,000 + 39,200 = 54,200$ boxes.

(ii) Fixed cost per box in 1991 $= \text{Rs. } 14,30,000 \div 65,000 \text{ boxes} = \text{Rs. } 22$

This is higher by 10% over 1990

Therefore, fixed cost for 1990 $= \text{Rs. } 20$

Now the break-up of the costs and prices can be indicated for opening stock and current production separately.

	Rs./Box	
	Opening Stock	Current Production
Variable Cost	20	25
Fixed cost	20	22
Profit	10	3
Selling Price	50	50

During 1991, total quantity of 75,000 boxes (15,000 representing O/Stock plus 60,000 from current production) are expected to be sold. The profit would thus be as under :

15,000 boxes @ Rs. 10 per box	Rs. 1,50,000
60,000 boxes @ Rs. 3 per box	1,80,000
Profit from 75,000 boxes	3,30,000

Problem 258. (Optimum Production mix - Constraint being availability of intermediate). A company manufactures three products from an intermediate produced in its own plant. The downstream units at full capacity operations require one lakh kilos of intermediate. However, in view of certain constraints, this output would be affected by 25%. Intermediate is charged to user divisions at Rs. 10 per kilo inclusive of its variable cost of Rs. 8 per kg.

Following particulars are furnished :

Downstream Units	A	B	C
Capacity (kgs.)	60,000	40,000	20,000
Intermediate required (Kgs.)	66,000	20,000	14,000
Variable cost (Rs./Kg.)	14	8	9
Fixed cost (")	3	5	3
Profit (")	3	2	4
Total Price (")	20	15	16

It is further given that :

- Constraints would prevail throughout the year and no other arrangement is possible to meet shortage ;
- Company had an opening stock of 7,500 kgs. and minimum stock of 2,500 kgs. has to be maintained in any case ; and

- (c) For economic operations plants have to be operated at a minimum of 70% capacity.

Required :

- (i) To suggest the most profitable mix ;
- (ii) To compute the loss suffered as a result of main plant operating at 75% capacity ; and
- (iii) To refix the price of the products so as to retain the same profit.

Solution: (i)

	<i>Products</i>		
	<i>A</i>	<i>B</i>	<i>C</i>
Capacity at 100% level (kgs)	60,000	40,000	20,000
Intermediate required (kgs.)	66,000	20,000	14,000
Intermediates required per kg. of finished products (Kg.)	1.1	0.5	0.7
Contribution/Kg. (F.C. + Profit)	Rs. 6	Rs. 7	Rs. 7
Contribution/Kg. of intermediate	5.45	14	10
Ranking	III	I	II
Intermediate required at a minimum of 70% capacity (Kgs.)	46,200	14,000	9,800
			<i>Total</i>
			70,000

The total minimum requirement of the intermediate is 70,000 kgs. However, the quantity available is :

From opening inventory	5,000 kgs.
From production at 75% capacity	75,000 kgs.
	<u>80,000</u>

So, 10,000 kgs. of intermediate is available for production of most profitable product-mix based on the above ranking. For balance 30%, the requirement of intermediate will be :

<i>Rank</i>	<i>Product</i>	<i>Requirement of intermediate at 30% balance capacity</i>	<i>Balance</i>
I	B	$40,000 \times 30\% \times 0.5 = 6,000$	4,000
II	C	$20,000 \times 30\% \times 0.7 = 4,000$ *	-
III	A	----	----
		<u>10,000</u>	

By utilizing intermediate of 4,000 units, the final production of C = $(20,000 + 14,000) \times 4,000 = 5,714$

Based on the above working the optimum product mix will be as under :

Products

A (70% of 60,000 kgs.)	42,000 kgs.
B (100% of 40,000 kgs.)	40,000 "
C (first at 70% of 20,000 kgs.) =	14,000

* Required 4200, but restricted to 4,000 as maximum available

(then additional production

by utilizing 4,000 kgs. of intermediate 5,714 19,714 "

(ii) Loss incurred due to main plant operating at 75% capacity.

(a) On finished products

A (18,000 kgs. × Rs. 6 contribution)	Rs. 1,08,000	
C (20,000 kgs. – 19,714 kgs) × Rs. 7	<u>2,002</u>	1,10,002

(b) On intermediate

Production loss 25% of 1,00,000 kgs. = 25,000 kgs.

Loss in contribution per kg (Rs. 10 – 8) = Rs. 2

Total loss (25,000 kgs. × Rs. 2) 50,000

Total loss incurred 1,60,002

(iii) Upward revision of prices to eliminate loss and retain the same profit

Loss as per (ii) above Rs. 1,60,002

Total intermediate used 80,000 kgs.

Loss per kg. Rs. 2.00

This loss will be recovered on the basis of consumption norms for different products.

The revised prices would be as under :

Products	Existing Prices	Increase	Revised Prices
A	Rs. 20	1.1 kg × Rs. 2 = Rs. 2.20	Rs. 22.20
B	15	0.5 kg × Rs. 2 = Re. 1.00	16.00
C	16	0.7 kg. × Rs. 2 = Rs. 1.40	17.40

Problem 25. (Capital Budgeting—Cost benefit of modification scheme—ROI) The Plant Manager has proposed a scheme of modifications to remove imbalance in plant which would cost Rs. 200 lakhs. The plant is operated for 8,000 hours round the clock in continuous operation and is taken off for annual shutdown of one month. Hooking up of the scheme would require 50 days.

Following improvements are envisaged :

- (1) Raw materials consumption would improve to 1.04 from 1.05 as at present.
 - (2) Production capacity would go up by 10% from existing one of 10,000 tonnes per annum.
 - (3) Hourly steam consumption of 10 tonnes would be improved by 10%.
- Operational cost of the scheme is indicated as under :

- (1) Five additional operators would be required in each shift. Aggregate emoluments are Rs. 2,000 per month ;
- (2) Repairs and maintenance cost is estimated @ 3% of the total cost of the scheme;
- (3) Power consumption would be Rs. 100 per hour ; and
- (4) Additional overheads would be Rs. 25,000 per month.

Further information to examine viability of the scheme are as under :

Further information to examine viability of the scheme are as under :

- (1) Product is sold at Rs. 20,000 per tonne ;
- (2) Variable cost is Rs. 12,000 while raw material is purchased at Rs. 6,000 per tonne; and
- (3) Steam costs Rs. 300 per tonne which includes fuel cost of Rs. 240 and chemicals of Rs. 10.

Since own funds are limited, term loan to the extent of 50% would be procured carrying interest @ 15% payable at year-end along with 10% of principal amount.

Depreciation on WDV basis is provided @ 30%

Tax is payable @ 50% on net income after proposed depreciation.

It is the corporate policy to expect a post-tax return of 14% on total investments of own funds and considering three years spectrum for any major modifications. It is generally assumed that all cost elements and selling price will remain unchanged and to ignore all cash inflows, if any, while evaluating viability of such schemes.

There is some hesitation in approving the scheme. You are, therefore, consulted to examine various aspects of the scheme and its financing.

You are required to tender your advice on desirability and viability in executing the scheme having regard to the corporate policy.

Solution:

Benefits from the proposed modification scheme

	<i>Rs lakhs</i>
(i) Saving due to increase in production capacity by 1,000 tonnes × Rs. 8,000 (contribution/tonne)	80.00
(ii) Saving due to lower consumption of R.M. 0.01 × 11,000 tonne × Rs. 6,000	6.60
(iii) Saving in steam consumption 1 tonne per hour × 8000 tonnes × Rs. 250	20.00
Total savings – (A)	<u><u>106.60</u></u>

Additional operating cost of the proposed scheme

(i) 5 operators per shift @ Rs. 2000 aggregate emoluments p.m. (5 × 3 shifts × Rs. 2,000 × 12 months)	3.60
(ii) Repairs and maintenance (Rs. 200 lakhs × 3%)	6.00
(iii) Power consumption (Rs. 100 per hour × 8000 hours)	8.00
(iv) Overheads (Rs. 25,000 p.m. × 12)	3.00
Total additional costs – (B)	<u><u>20.60</u></u>
Net Savings (A) – (B)	<u><u>86.00</u></u>

**Statement showing the calculation of post-tax
return on investment**

	<i>Rs. Lakhs</i>		
	<i>Years</i>		
	1	2	3
Net Savings as above	86.00	86.00	86.00
<i>Loss:</i> Interest on term loan			
Yr. 1 Rs. 100 lakhs × 15%, Yr 2 Rs. 90 lakhs			
× 15%, Yr. 3. Rs. 80 lakhs × 15%	15.00	13.50	12.00
Depreciation (Rs. 200 lakhs at 30% WDV basis)	60.00	42.00	29.40
Net income before tax	11.00	30.50	44.60
Tax 50%	5.50	15.25	22.30
Post-tax income	5.50	15.25	22.30

Average for 3 years = Rs. 14.35 lakhs

Total investment own funds Rs. 100 lakhs.

Post tax return on own investment = $14.35/100 \times 100 = 14.35\%$

Since the corporate policy is to expect a 14% post-tax return on own investment, the proposed modification scheme is quite viable. However, the following factors may be considered before a final decision is taken to implement the proposal :

(a) Tax benefits available on new investments have not been indicated in the question and as such the same not considered in the project appraisal.

(b) Discounting factors for years 2 and 3 are not given in the question. It is assumed that all projections of costs and benefits can be determined with certainty.

(c) Commissioning of a capital projects normally takes one to two years. Interest on borrowed funds will have to be paid during the pre-commissioning stage out of own invested funds

(d) It is given that plant is shutdown for one month for annual maintenance. In addition, hooking up of the scheme would require 50 days. Therefore, hooking up should be linked to annual shutdown period.

Even with this arrangement, contribution lost due to additional shutdown of 20 days (50 days less 30 days) on account of hooking up the scheme has to be considered.

Production per hour = Total production / operating hours

= 10,000 tonnes / 8000 hrs. = 1.25 tonne per hour

Production per day = 1.25 × 24 hours = 30 tonne

Contribution lost for 20 days = 600 tonnes × Rs. 8000 = Rs. 48 lakhs

Assuming 50% saving in tax, the net contribution lost would be Rs. 24 lakhs. If this is considered in computing the post-tax return, the return would work out to less than 14%, and as such the scheme may not eventually be viable.

Problem 260. (Variance Analysis Preparation of original and flexible budgets). The Accountant of a company has presented the following

operating statement to the General Manager of Department 'P' for the month of May 1991.

	Budget	Actual May 1991	Variance
	Rs.	Rs.	Rs.
Sales	24,00,000	22,00,000	2,00,000
Direct Materials	6,00,000	5,20,000	80,000
Direct Labour	8,00,000	7,56,000	44,000
Factory Overheads (V)	2,00,000	1,84,000	16,000
Factory Overheads (F)	1,00,000	1,16,000	(16,000)
Selling Overheads (V)	3,00,000	2,88,000	12,000
Selling Overheads (F)	2,00,000	1,84,000	16,000
Total	22,00,000	20,48,000	1,52,000
Profit	2,00,000	1,52,000	(48,000)
Direct Labour Hours	1,00,000	95,000	
Units of Production and Sale	20,000	18,000	

The General Manager was surprised to see that his operations have resulted in an adverse profit variance of Rs. 48,000 for the month. On the basis of the budgeted profit of Rs. 10/- per unit, he expected that he would make a profit of Rs. 1,80,000 on a sale of 18,000 units of production in May 1991 instead of the budgeted profit of Rs. 2,00,000 resulting in an adverse profit variance of Rs. 20,000 only.

You are required to :

- Redraft the above statement to show the original budget, flexible budget, actual expenses incurred and variations for May 1991.
- Calculate all variances relating to sales, direct materials, direct labour and overheads.

Solution :

(i) **Flexible Budget for May 1991**

	Original Budget	Flexible Budget for May 1991	Actuals May 1991	Variance
Sales (units)	20,000	18,000	18,000	
	Rs.	Rs.	Rs.	
Sales	24,00,000	21,60,000	22,00,000	40,000 (F)
Variable Cost :				
D. Material	6,00,000	5,40,000	5,20,000	20,000 (F)
D. Labour	8,00,000	7,20,000	7,56,000	36,000 (A)
Factory O.H. (V)	2,00,000	1,80,000	1,84,000	4,000 (A)
Selling O.H. (V)	3,00,000	2,70,000	2,88,000	18,000 (A)
Total V. Costs	19,00,000	17,10,000	17,48,000	38,000 (A)
Contribution	5,00,000	4,50,000	4,52,000	2,000 (F)

Fixed Costs :

Factory O.H. (F)	1,00,000	1,00,000	1,16,000	16,000 (A)
Selling O.H. (F)	2,00,000	2,00,000	1,84,000	16,000 (F)
Total F. Costs	3,00,000	3,00,000	3,00,000	---
Profit	2,00,000	1,50,000	1,52,000	2,000 (F)
Volume Variance	(2,00,000 - 1,50,000)			50,000 (A)
Net loss				1,48,000

(ii) Computation of Variances

M_1 —Actual Cost of Material Rs. 5,20,000

M_2 —Standard Cost of Material used
i.e., $(6,00,000 + 20,000) \times 18,000$ Rs. 5,40,000

M_3 —No Mix

M_4 —Standard Material cost of output
 $(6,00,000) + 20,000 \times 18,000$ Rs. 5,40,000

Material Price Variance = $M_1 - M_2 = 5,20,000 - 5,40,000$ 20,000 (F)

L_1 —Actual Payment to workers for actual hours Rs. 7,56,000

L_2 —Actual hours worked at standard rate
 $9500 \text{ hrs.} \times (80,000 + 1,00,000)$ 7,60,000

L_3 —Standard labour Cost for output
 $(8,00,000 + 20,000) \times 18,000$ 7,20,000

Wage Rate Variance = $L_1 - L_2 = \text{Rs. } 7,56,000 - 7,60,000$ Rs. 4,000 (F)

Wage Efficiency Variance = $L_2 - L_3 = \text{Rs. } 7,60,000 - 7,20,000$ Rs. 40,000 (A)

For Factory Variable Overheads

VO_1 —Actual Variable OH Rs. 1,84,000

VO_2 —Actual hours worked at standard variable O.H. rate
 $(2,00,000 + 1,00,000) \times 95,000$ = 1,90,000

VO_3 —Standard variable O.H. for production
 $(2,00,000 + 2,00,000 \text{ units}) \times 18,000 \text{ units}$ 1,80,000

V.O. Exp. Variance = $VO_1 - VO_2 = \text{Rs. } 1,84,000 - 1,90,000 = \text{Rs. } 6,000$ (F)

V.O. Efficiency Variance = $VO_2 - VO_3 = 1,90,000 - 1,80,000 = 10,000$ (A)

For Selling V.O. Variance

1. Actual Selling O.H. incurred 2,88,000

2. Selling Variable O.H. for production as per standard rate
 $(3,00,000 + 20,000) \times 18,000$ 2,70,000

Selling Variable O.H. Variance = $2,88,000 - 2,70,000$ Rs. 18,000 (A)

Factory F.O. Variance

FO_1 — Actual F.O. incurred Rs. 1,16,000

FO_2 — Budgeted fixed OH for the period 1,00,000

FO_3 — No Calendar Variance

FO_4 — Standard F.O. for actual hours worked
 $(\text{Rs. } 1,00,000 + 1,00,000 \text{ hrs.}) \times 95,000 \text{ hrs.}$ 95,000

FO₅— Standard F.O. for production

$$(\text{Rs. } 1,00,000 + 20,000) \times 18,000 \quad 90,000$$

$$\text{F.O. Exp. Variance} = \text{FO}_1 - \text{FO}_2 = \text{Rs. } 1,16,000 - \text{Rs. } 1,00,000 = 16,000 \text{ (A)}$$

$$\text{F.O. capacity variance} = \text{FO}_2 - \text{FO}_4 = \text{Rs. } 1,00,000 - 95,000 = 5,000 \text{ (A)}$$

$$\begin{aligned} \text{Fixed O.H. Efficiency Variance} &= \text{FO}_4 - \text{FO}_5 \\ &= \text{Rs. } 95,000 - 90,000 = 5,000 \text{ (A)} \end{aligned}$$

For Selling F.O. Variance

$$\text{FO}_1\text{—Selling F.O. incurred} \quad 1,84,000$$

$$\text{FO}_2\text{—Budgeted fixed O.H.} \quad 2,00,000$$

$$\begin{aligned} \text{FO}_5\text{—Selling F.O. for production at standard rate} \\ (2,00,000 + 20,000) \times 18,000 \text{ units} \end{aligned} \quad = 1,80,000$$

$$\text{Selling F.O. Expenses variance} = \text{FO}_1 - \text{FO}_2 = 1,84,000 - 2,00,000 = 16,000 \text{ (F)}$$

$$\begin{aligned} \text{Selling F.O.H. Efficiency Variance} &= \text{FO}_2 - \text{FO}_5 \\ &= \text{Rs. } 2,00,000 - \text{Rs. } 1,80,000 = 20,000 \text{ (A)} \end{aligned}$$

For Sales Margin Variance

SM₁—Actual Sales Margin on actual sales effected i.e. difference between realisation from actual sales and standard cost

$$(\text{Rs. } 2,20,000 - (2,20,000 + 20,000) \times 18,000) = \text{Rs. } 2,20,000$$

SM₂— Standard Margin on Actual Sales

$$(\text{Rs. } 2,00,000 + 20,000) \times 18,000 = 1,80,000$$

SM₄— Standard Sales Margin on Budgeted Sales = 2,00,000

$$\text{Sales Margin price variance} = \text{SM}_1 - \text{SM}_2 = 2,20,000 - 1,80,000 = 40,000 \text{ (F)}$$

$$\text{Sales Margin volume variance} = \text{SM}_2 - \text{SM}_4 = 1,80,000 - 2,00,000 = 20,000$$

Check—Reconciliation

<i>Profit as per budget</i>			Rs. 2,00,000
<i>Variance</i>	<i>F</i>	<i>A</i>	
Sales Margin Price Variance	40,000		
Sales Margin Volume Variance		20,000	
Direct Material Price Variance	20,000		
Wage Rate Variance	4,000		
Wage Efficiency Variance		40,000	
Factory Variable O.H. Exp. Variance	6,000		
Factory Variable O.H. Efficiency Variance		10,000	
Selling Variable O.H. Variance		18,000	
Factory Fixed O.H. Exp. Variance		16,000	
Factory Fixed O.H. Capacity Variance		5,000	
Factory Fixed O.H. Efficiency variance		5,000	
Selling Fixed O.H. Exp. Variance	16,000		
Selling fixed O.H. Efficiency Variance		20,000	
	<u>86,000</u>	<u>1,34,000</u>	<u>48,000</u>
Actual Profit			<u>1,52,000</u>

For question on Hotel Costing, please refer to similar Problem A—22.

For question on apportionment of joint costs, please refer to similar Problem 8-5

Problem 261. (Combined Budgeted P & L Statement including Cash Budget). A single product company prepares quarterly budgets. Budgeted variable costs per unit are as under :

Direct Materials	Rs. 24
Direct Labour 8 hours (Rs. 6 per hour)	Rs. 48
Factory Overheads	Rs. 16
Selling Price	Rs. 180

Administration overhead is Rs. 1,00,000 per month and fixed factory overhead is Rs. 90,000 per month including Rs. 20,000 depreciation. The normal capacity of the factory is 3,000 units per month. Finished goods stocks are valued at full factory cost of production and the budgeted opening stock on 1st July 1991 is estimated at 2,400 units valued at Rs. 2,66,000. It is the policy of the company to keep the opening finished stock of each month at a constant ratio to the budgeted unit sales of that month. Extra production in excess of the capacity of 3,000 units per month can be achieved by working overtime at double the labour hour rate.

Estimated sales are as under :

Month	Units
June 1991	2,600
July 1991	2,000
August 1991	2,800
September 1991	3,200
October 1991	3,600

The direct material costs relating to the production of each month are paid for in the succeeding month. The pattern of collection of sales are as under :

- 30% in the same month
- 70% in the next month

All other costs are paid in the month in which they are incurred. An instalment of deferred payment of Rs. 14,000 in respect of the purchase of machinery is due for payment in July 1991. The company has to pay dividend amounting to Rs. 15,000 in September 1991. The projected cash balance on 1st July, 1991 is Rs. 1,00,000.

Required :

- (i) Prepare a combined budgeted Profit & Loss Statement for the quarter ended 30th September, 1991.
- (ii) Prepare a cash budget for each of the three months of the quarter ended 30th September, 1991 viz. July, August and September 1991.

Solution :

Preliminary Workings

It is given in the question that as per policy of the company opening finished stock of each month is kept at a constant ratio to the budget sales units of that month. The ratio of stock to sales is thus arrived at as under :

July 1991 : Opening Stock
Sales
Ratio of Stock to Sales

2,400 units
2,000 units
1:2 times
(In units)

	June	July	August	Sept.	Oct.
Sales	2,600	2,000	2,800	3,200	3,600
Opening Stock 1.2 times	3,120	2,400	3,360	3,840	4,320
Closing Stock (i.e. O/S of next month)	2,400	3,360	3,840	4,320	-
Increase/decrease in stock	(720)	960	480	480	
Sales	2,600	2,000	2,800	3,200	
Closing Stock	2,400	3,360	3,840	4,320	
Total	5,000	5,360	6,640	7,520	
Less: Opening stock	3,120	2,400	3,360	3,840	
Production	1,880	2,960	3,280	3,680	9,920
Capacity		3,000	3,000	3,000	
Production at overtime		—	280	680	960

Statement showing combined P & L for the
Quarter ended 30th Sept., 1991

Sales (8,000 × Rs. 180)	Rs. 14,40,000
Cost of production – Variable (9,920 × Rs. 88)	8,72,960
Overtime (960 × Rs. 48)	46,080
Fixed Factory Overheads (90,000 × 3)	2,70,000
Total Factory Cost	11,89,040
Less: Closing Stock (Rs. 11,89,040 ÷ 9,920) × 4320	5,17,808
	6,71,232
Add Opening stock of 2,400 units	2,66,000
Total Cost of production	9,37,232
Administrative overheads (Rs. 1,00,000 × 3)	3,00,000
Cost of production of goods sold	12,37,232
Profit	2,02,768

(ii)	June	July	Aug.	Sept.
Sales (units)	2,600	2,000	2,800	3,200
Sales Value @ Rs. 180 (Rs.)	4,68,000	3,60,000	5,04,000	5,76,000
Collections - current 30%	1,40,400	1,08,000	1,51,200	1,72,800
-Next month 70%		3,27,600	2,52,000	3,52,800
Total		4,35,600	4,03,200	5,25,600
Production (units)	1,880	2,960	3,280	3,680
Raw materials @ Rs. 24 (Rs.)	45,120	71,040	78,720	88,320
Direct wages @ Rs. 48	90,240	1,42,080	1,57,440	1,76,640
Overtime @ Rs. 48	—	—	13,440	32,640
Variable overheads @ Rs. 16	30,080	47,360	52,480	58,880
Receipts (Rs.) (A)		4,35,600	4,03,200	5,25,600
Payments:				
Raw materials		45,120	71,040	78,720
Direct Wages		1,42,080	1,57,440	1,76,640
Overtime		—	13,440	32,640
Variable overheads		47,360	52,480	58,880
Fixed Factory Overheads		70,000	70,000	70,000
Admn. Overheads		1,00,000	1,00,000	1,00,000

Deferred Payment	14,000	---	---
Dividend	---	---	15,000
Total (B)	4,18,560	4,64,400	5,31,880
Surplus/Deficit (A) - (B)	17,040	(61,200)	(6,280)
Add : Opening balance	1,00,000	1,17,040	55,840
Closing balance	1,17,040	55,840	49,560

• **Problem 262. (Controllable and Uncontrollable variances—Preparation of actual and revised budgets).** In October 1989, Better Budgets Ltd. prepared its budget for the year 1990 at the then prevailing prices as under :

		Rs.
Sales Revenue (20,000 units @ Rs. 9 per unit)		1,80,000
Less: Variable Cost		
Material	50,000	
Labour	51,000	
Variable Overheads	30,000	
Selling Expenses	6,000	
		1,37,000
Contribution		43,000
Less: Fixed Cost		24,000
Budgeted Profit		19,000

It was felt that adjustments should be made to this Budget in view of the rising price changes. Accordingly, the Budget was revised taking into account the impact of anticipated inflation on costs as follows :

- (i) The price per lb. of material was expected to rise during 1990 from Re. 0.50 (the price put in the original budget) to Re. 0.53 and finally to Re. 0.55. As 1,00,000 lb. of material is required to produce 20,000 units, it was envisaged that 25,000 lb. would be brought at Re. 0.50 per lb., 50,000 lb. at Re. 0.53 per lb. and 25,000 lb. at Re. 0.55 lb.
- (ii) The cost of labour was expected to rise from Rs. 2.55 per hour (the figure in the original budget) to Rs. 2.85 per hour. As each completed unit required 1 hour of labour it was envisaged that 10,000 units would be produced at the old rate of Rs. 2.55 per hour and the balance would be at the new rate of Rs. 2.85 per hour.
- (iii) It was envisaged that the variable overheads would rise in line with the anticipated level of 20% inflation in 1990 and in effect, the increase will be worked out on an average 10%.
- (iv) Fixed cost would be affected likewise and a similar treatment would be used to record the increase.

The revised Budget brought down the profit figure to Rs. 7,850 and the actual working in 1990 resulted in a profit of Rs. 7,350.

An analysis of the actual figures revealed the following :

- (i) The sales revenue of Rs. 1,85,000 arises from the sale of 10,000 units at Rs. 9 per unit and 10,000 units at Rs. 9.50 per unit.
- (ii) The cost of material is made up of 27,500 lb. at Rs. 0.50 per lb., 55,000 lb. at Re. 0.53 per lb. and 27,500 lb. at Re. 0.56 per lb.
- (iii) The cost of labour is made up of 10,000 hours at Rs. 2.55 per hour and 8,333 hours at Rs. 3.15 per hour.

- (iv) The general inflation rate was 24% instead of the anticipated 20%—in effect 12% on an average. The actual figures in 1990 of variable overheads was Rs. 33,600 and fixed cost Rs. 28,000.

You are required to draw up the revised Budget, the actual figures for 1990, make a comparison and account for the drop in profit viz. Rs. 500 from the revised Budget by analysing the variances as controllable and non-controllable.

Solution :

	1990			
	Revised		Actual	
	Rs.	Rs.	Rs.	Rs.
Sales Revenue (20,000 units)		1,80,000		1,85,000
Less: Variable Costs :				
Direct Material	52,750		58,300	
Labour	54,000		51,750	
Variable overheads	33,000		33,600	
Selling Expenses	6,000	1,45,750	6,000	1,49,650
Contribution		34,250		35,350
Less Fixed Cost		26,400		28,000
Profit		7,850		7,350

Variance Analysis : (Refer to working notes for computations)

Variance	Total	Non-controllable	Controllable
Selling Price	5,000 (F)	5,000 (F)	
Material Price	275 (A)	275 (A)	
Material Usage	5,275 (A)		5,275 (A)
Labour Rate	2,500 (A)	2,500 (A)	
Labour Efficiency	4,750 (F)		4,750 (F)
Variable O.H.	600 (A)	600 (A)	
Fixed O.H. Exp.	1,120 (A)	1,120 (A)	
Fixed O.H. Efficiency	480 (A)		480 (A)
	500 (A)	505 (F)	1005 (A)

Working Notes :

Material cost variance

M_1 — Actual Material cost incurred

$$(27,500 \times 0.50) + (55,000 \times 0.53) + (27,500 \times 0.56) \quad \text{Rs. 58,300}$$

M_2 — Material used at standard cost

$$(27,500 \times 0.50) + (55,000 \times 0.53) + (27,500 \times 0.55) \quad \text{Rs. 58,025}$$

M_4 — Standard Material Cost (Revised) for output

$$(25,000 \times 0.50) + (50,000 \times 0.53) + (25,000 \times 0.55) \quad \text{Rs. 52,750}$$

$$\text{Material Price Variance} = M_1 - M_2 = \text{Rs. 58,300} - 58,025 \quad \text{Rs. 275 (A)}$$

$$\text{Material Usage Variance} = M_2 - M_4 = 58,025 - 52,750 \quad \text{Rs. 5,275 (A)}$$

Labour Cost Variance

L_1 —	Actual Labour Cost incurred (10,000 × 2.55) + (8,333 × 3.15)	Rs. 51,750 (Appx.)
L_2 —	Actual hours at standard rate (10,000 × 2.55) + (8,333 × 2.85)	49,250 (Appx)
L_5 —	Standard Labour Cost for output • (10,000 × 2.55) + (10,000 × 2.85)	54,000
Labour Rate Variance = $L_1 - L_2$ = Rs. 51,750 - Rs. 49,250 = Rs. 2,500 (A)		
Labour Efficiency Variance = $L_2 - L_5$ = Rs. 49,250 - 54,000 = Rs. 4,750 (F)		

For Variable O.H. Variance

VO_1 —	Actual Variable O.H. incurred	Rs. 33,600
VO_3 —	Variable O.H. for production as per revised budgeted 3 00,000 × (110 + 100)	33,000
Variable O.H. Exp. Variance = $VO_1 - VO_3$ = Rs. 33,600 - 33,000 = 600 (A)		

For Fixed Overhead Variance

FO_1 —	Fixed O.H. incurred	Rs. 28,000
FO_2 —	Fixed O.H. for the period or Revised Budget at given inflation rate [(26,400 × (112 + 110))]	26,880
FO_5 —	Std. Fixed O.H. Cost for production (Revised) (24,000 × 1.10)	26,400
F.O. Exp. Variance = $FO_1 - FO_2$ = Rs. 28,000 - 26,880 = 1,120 (A)		
F.O. Volume Variance = $FO_2 - FO_5$ = 26,880 - 26,400 = 480 (A)		

Problem 263. (Accept/Reject a project - Probability) Norish Investments Ltd. possesses Rs. 90,000 cash and has the opportunity to invest in 3 projects, the outcomes of which depend on two states of economic circumstances that is states of nature. Each outcome will last one year and the cash flows for each alternative are estimated to be as follows :

States of nature	I	II
Probability of states of nature	0.5	0.5
Cash inflows less Cash outflows (Rs.)		
Project A	- 40,000	+60,000
Project B	+50,000	- 50,000
Project C	+9,000	+ 8,000

The cashflows are arrived at after deducting initial outlays of Rs. 40,000 for project A, Rs. 50,000 for project B and Rs. 90,000 for project C. The following alternatives are available for an investment of Rs. 90,000.

- Accept any one of the projects A, B or C and reject the other two projects.
 - Accept both projects A and B.
- What is your recommendation ?

Solution :

Project A			
<i>State of nature</i>	<i>Cash flow</i>	<i>Probability</i>	<i>Expected Value</i>
<i>I</i>	-40,000	0.5	-20,000
<i>II</i>	+60,000	0.5	+ 30,000
Expected Value of Cashflow			<u>+ 10,000</u>
Project B			
<i>I</i>	+ 50,000	0.5	+ 25,000
<i>II</i>	- 50,000	0.5	- 25,000
Expected Value of Cashflow			<u>0</u>
Project C			
<i>I</i>	+ 9,000	0.5	+ 4,500
<i>II</i>	+ 8,000	0.5	+ 4,000
Expected Value of Cashflow			<u>+ 8,500</u>
Project A and B			
<i>I</i>	+ 10,000	0.5	+ 5,000
<i>II</i>	+ 10,000	0.5	+ 5,000
Expected Value of Cash flow			<u>+ 10,000</u>

Both projects viz. project A and project A & B give the highest expected value (Rs. 10,000) as compared to Project B and Project C. Project A seems to be risky as one state of nature give a negative cashflow. Project A & B together utilizes the entire outlay of Rs. 50,000 and as such the same should be chosen.

Standard Deviation

Project A = 50,000 Covariance = - 2,500 million

Project B = 50,000

Correlation between A & B = - 2500 million,

$$50,000 \times 50,000 = - 1$$

Projects A & B are perfectly correlated (negative) and thus risk is completely eliminated.

For question on Debandhu Printer —Soft back edition of a new book on computer, please refer to Example 20.17 of the book "Advanced Cost and Management Accounting—Text" by Saxena and Vashist.

For question on Woodland General Hospital - decision of closing down a department, please refer to Example 10-25 of the book "Advanced Cost and Management Accounting—Text" by Saxena and Vashist.

Problem 264. (Linear Programming). A company has two divisions A and B. Division B sells two products B1 and B2 made of 3 materials A1, A2, A3 produced by division A. Division A has no outside market for these 3 materials. The following details are relevant.

	<i>A1</i>	<i>A2</i>	<i>A3</i>
Variable cost per unit Rs.	1.00	0.50	—
Quantity used			
(Units) per unit of <i>B1</i>	2	0.5	1
<i>B2</i>	2	2	3
Processing capacity			
(Unit/week) in Division A	4,000	3,000	4,800

The price and variable processing cost for products B1 and B2 are :

	B1	B2
	Rs.	Rs.
Price	8	14
Processing cost in division B	2	1.75

The overall profitability of the company has to be maximised and with this end in view, formulate the optimisation problem as a linear programming model and calculate the optimum units of products in both the divisions as well as the overall profit.

Solution:

Let Y_1 and Y_2 be the amounts of B1 & B2 respectively and let

X_1 X_2 X_3 be the amounts of A1 A2 A3 produced.

The Capacity constraints :

$$X_1 \leq 4,000, \quad X_2 \leq 3,000, \quad X_3 \leq 4,800$$

The demand for each of the 3 of the Divisions A Products in terms of the amount of the 2 of the Division B products to be produced is given by

$$2Y_1 + 2Y_2 - X_1 = 0$$

$$0.5Y_1 + 2Y_2 - X_2 = 0$$

$$Y_1 + 3Y_2 - X_3 = 0$$

The model to be formulated

$$\text{Maximize } (8 - 2) Y_1 + (14 - 1.75) Y_2 - 1X_1 - 0.5X_2 - 0.75X_3$$

$$\text{Subject to } 2Y_1 + 2Y_2 - X_1 = 0$$

$$0.5Y_1 + 2Y_2 - X_2 = 0$$

$$Y_1 + 3Y_2 - X_3 = 0$$

$$X_1 \leq 4,000$$

$$X_2 \leq 3,000$$

$$X_3 \leq 800$$

$$Y_1, Y_2, X_1, X_2, X_3 \geq 0$$

The optional solution for this problem is

$$Y_1 = 666.67 \quad Y_2 = 1333.33 \quad X_1 = 4,000$$

$$X_2 = 3,000 \quad X_3 = 4661.67 \text{ yielding a profit of Rs. 11,333.}$$

Problem 265. (Capital budgeting - ROI considering inflation factor) A company has got five divisions and each division is considered as an Investment Centre. Its performance is measured by the return on investment percentage. Division A has five identical machines of different ages. Each machine costs Rs. 60,000 and generates a net cash flow (revenues less variable cost and traceable fixed cost) of Rs. 20,000 per year for 5 years. After five years of operation, the machine has only zero salvage value. The division has reached a steady state in which each year a five-year old machine is scrapped and a new one purchased. The company uses straight line depreciation for financial accounting. With five machines each generating a depreciation charge of Rs. 12,000 per year, the total depreciation charge works out to Rs. 60,000 per year. When this is subtracted, from the net cashflow of 5 machines per year viz., Rs. 1,00,000, the net income will be Rs. 40,000. For assessing divisional

performance, tax effects are ignored and it is assumed that all cashflows and investments occur on the last day of the year. The working is as under :

<i>Age of machine (Years)</i>	<i>Book Value Rs.</i>
0	60,000
1	48,000
2	36,000
3	24,000
4	12,000
Total book value	<u>1,80,000</u>

$$ROI = \frac{40,000}{1,80,000} = 22.2\%$$

To the new Finance Manager who has jointed the company quite recently, the Divisional Accountant showed these figures and added as under :

"For the past 4 years, a 10% per year inflation exists in the economy and the price of the division's machines also increase at this 10% per year inflation rate. However, the division is not able to keep pace with the inflation in rising the prices, fast enough, but has been able to increase the net cashflow by 6% per year during the four-year inflationary period. But after 4 years, the division is not worse-off, rather it has been able to show an increased ROI of 22.2%."

The Finance Manager wanted to see the workings. After seeing the workings, he expressed his grave concern thus :

"The whole thing is a distortion of facts and will easily mislead the management. The increase in ROI is caused by the failure to restate the machine's historical acquisition costs into units of current costs or current purchasing power. Were the inflation rate to cease suddenly at the end of year 4 and the division maintains its the then current net operating cashflows and replaces its old machines one per year at the most recent price, what will be the position ? The result is dramatic as you will now see." He then gave a working which resulted in a ROI of 14.6%.

- (i) Do you agree with the Finance Manager ?
- (ii) Show the workings of the Divisional Accountant and the Finance Manager.

Solution:

Accountant's Working

Investment (Net Block) and Depreciation considering 10% annual inflation

<i>Age of Machine years</i>	<i>Machine Cost Rs.</i>	<i>Inflation factor at 10%</i>	<i>Cost (2) × (3)</i>	<i>Depreciation 20%</i>	<i>Net Book value (Net Block) Rs.</i>
(1)	(2)	(3)	(4)	(5)	
0	60,000	(1.10) ⁴	87,846	17,570	87,846 - [(17,570 × 0)] = 87,846
1	60,000	(1.10) ³	79,860	15,972	79,860 - [(15,972 × 1)] = 63,888
2	60,000	(1.10) ²	72,600	14,520	72,600 - [(14,520 × 2)] = 43,560

3	60,000	(1.10)	66,000	13,200	$66,000 - [(13,200 \times 3)] = 26,400$
4	60,000	—	60,000	12,000	$60,000 - [(12,000 \times 4)] = 12,000$
			<u>3,66,306</u>	<u>73,262</u>	<u>2,33,694</u>

Net Cash flow = $1,00,000 \times (1.06)^4$ (Refer to Note)	Rs. 1,26,248
Less: Depreciation	<u>73,262</u>
Net Income	52,986
Investment	<u>2,33,694</u>

$$ROI = (52,986 + 2,33,694) \times 100 = 22.67\%$$

Finance Manager's Working. The points to be considered for correctly interpreting the statement of Finance Manager and (i) Inflation factor (ii) Age of Machine (iii) Replacement of old machine one per year at the most recent price i.e., inflated price. Therefore total net block for ROI computation for any year after considering inflation and age of asset will be as follows :

Age of Machine cost after considering both inflation and age

Machine

0	87846	=	Rs. 87,846
1	$87846 \times \frac{4}{5}$	=	70,277
2	$87846 \times \frac{3}{5}$	=	52,708
3	$87846 \times \frac{2}{5}$	=	35,138
4	$87846 \times \frac{1}{5}$	=	17,569

Total investment relevant to a year for ROI computation considering both inflation and age of machine

2,63,538

Depreciation at inflated price for five Machine at 20%

$(87,846 \times 0.20) \times 5$ Machine	Rs. 87,846
Net Cash Flow = $100,000 \times (1.06)^4$	1,26,248
Less : Depreciation at the most recent price (inflated)	<u>87,846</u>
	<u>38,402</u>
ROI = $Rs. 38,402 + 2,63,538 \times 100$	<u>= 14.6%</u>

Comment—Finance Manager is correct

Note—The company is able to increase the net cash flow by 6% per year during the four-year inflationary period. Therefore, annual cash flow considering this would be :

$$1,00,000 \times (1.06)^4 = Rs. 1,26,248$$

For question on Value Added, please refer to Example 11.21 of the book "Advanced Cost & Management Accounting—Text" by Saxena and Vashist.

C.I.M.A. London May 1991

Problem 266 (Integrated Accounts). XY Limited commenced trading of 1 February with fully paid issued share capital of Rs. 5,00,000, fixed assets of Rs. 2,75,000 and cash at bank of Rs. 2,25,000. By the end of April, the following transactions had taken place :

- ✓ 1. Purchases on credit from suppliers amounted to Rs. 5,72,500 of which Rs. 5,25,000 was raw materials and Rs. 47,500 was for items classified as production overhead.
- ✓ 2. Wages incurred for all staff were Rs. 6,76,000, represented by cash paid Rs. 5,00,000 and wage deductions of Rs. 1,75,000 in respect of income tax etc.
3. Payments were made by cheque for the following overhead costs :

✓ Production	Rs. 20,000
Selling	40,000
Administration	25,000
- ✓ 4. Issues of raw materials were Rs. 1,80,000 to Department A, Rs. 1,92,500 to Department B and Rs. 65,000 for production overhead items.
5. Wages incurred were analysed to functions as follows :

✓ Work-in-progress—Department A	Rs. 3,00,000
Work-in-progress—Department B	2,60,000
Production overhead	42,500
Selling overhead	47,500
Administration overhead	25,000
	6,75,000
- ✓ 6. Production overhead absorbed in the period by Department A was Rs. 1,10,000 and by Department B Rs. 1,20,000.
- ✓ 7. The production facilities, when not in use, were patrolled by guards from a security firm and Rs. 26,000 was owing for this service. Rs. 39,000 was also owned to a firm of management consultants which advises on production procedures, invoices for these two services are to be entered into the accounts.
8. The cost of finished goods completed was :

	<i>Department A</i>	<i>Department B</i>
✓ Direct labour	Rs. 2,90,000	Rs. 1,55,000
Direct materials	1,75,000	1,85,000
Production overhead	1,05,000	1,15,000
	5,70,000	5,55,000
- ✓ 9. Sales on credit were Rs. 8,70,000 and the cost of those sales was Rs. 7,00,000.
- ✓ 10. Depreciation of productive plant and equipment was Rs. 15,000.
- ✓ 11. Cash received from debtors totalled Rs. 5,20,000.
- ✓ 12. Payments to creditors were Rs. 1,50,000.

You are required :

- (a) to open the ledger accounts at the commencement of the trading period;
 (b) using integrated accounting, to record the transactions for the three months ended 30 April;
 (c) to prepare, in vertical format, for presentation to management : (i) a profit statement for the period; and (ii) the balance sheet at 30 April.

Solution : (a)

	Fixed 275	Assets	(All figures in Rs '000)
Balance b/f		Share Capital	
		Balance b/d	500
(b)		Bank	
Balance b/f	225	Wages control	500
Debtors control	520	Production overhead control	20
		Sales overhead control	30
		Admin overhead control	25
		Creditors control	150
		Balance c/f	10
	<u>745</u>		<u>745</u>
Balance b/d	10		
	Creditors Control		
Bank	150.0	Stores control	525.0
Balance c/d	487.5	Production overhead control	47.5
		Production overhead control	26.0
		Production overhead control	39.0
	<u>637.5</u>		<u>637.5</u>
		Balance b/f	437.5
	Provision for Depreciation		
		Production overhead control	15
	Stores Control		
Creditors Control	525.0	WIP—Department A	180.0
		WIP—Department B	192.5
		Production overhead control	65.0
	<u>52.0</u>	Balance c/f	87.5
Balance b/f	87.5		<u>525.0</u>
	Wages Control		
Bank	500	WIP—Dept. A	300.0
Wage deductions	175	WIP—Dept. B	260.0
		Production overhead control	42.5
		Sales overhead control	47.5
		Admin overhead control	25.0
	<u>67.5</u>		<u>675.0</u>
	Production Overhead Control		
Creditors control	47.5	WIP Control—Dept. A	110.0
Bank	20.0	WIP Control—Dept. B	120.0
Stores Control	65.0	Profit and Loss	25.0
Wages Control	42.5		
Creditors Control	26.0		
Creditors Control	39.0		
Provision for Depreciation	15.0		
	<u>255.0</u>		<u>255.0</u>
	Wage Deductions		
		Wages Control	175

WIP Control-Department A :			
Stores Control	180	Finished Goods Control	570
Wages Control	300	Balance c/f	20
Production Overhead Control	110		
	<u>590</u>		<u>590</u>
Balance b/f	20		
WIP Control-Department B :			
Stores Control	192.5	Finished Goods Control	555.0
Wages Control	260.0	Balance c/f	17.5
Production Overhead Control	120.0		
	<u>572.5</u>		<u>572.5</u>
Balance b/f	17.5		
Selling Overhead Control			
Bank	40.0	Profit and Loss	87.5
Wages Control	47.5		
	<u>87.5</u>		<u>87.5</u>
Admin Overhead Control			
Bank	25	Profit and Loss	50
Wages Control	25		
	<u>50</u>		<u>50</u>
Debtors Control			
Sales	870	Bank	520
		Balance c/f	350
	<u>870</u>		<u>870</u>
Balance b/f	350		
Finished Goods Control			
WIP Control--Dept. A	570	Cost of Sales	700
WIP Control--Dept. B	555	Balance c/f	425
	<u>1,125</u>		<u>1,125</u>
Balance b/f	425		
Cost of Sales			
Finished Goods Control	700	Profit and Loss	700
	<u>700</u>		<u>700</u>
Sales			
Profit and Loss A/c (c) (i)	870	Debtors	870

**Profit Statement for the period
from 1st February to 30th April**

Cost of Sales	700.0	Sales	870.0
Gross Profit	170.0		
	<u>870.0</u>		<u>870.0</u>
Production O.H.	25.0	Gross Profit	170.0
Adm. O.H.	50.0		
Selling O.H.	87.5		
Net Profit	7.5		
	<u>170.0</u>		<u>170.0</u>

(ii)

Balance Sheet as at 30th April

(Rs. in thousands)

Liabilities		Assets	
Share Capital	500.0	Fixed	275
Profit	7.5	Less : Depreciation	15
			<u>260</u>
Current Liabilities :		Current Assets :	
Creditors	487.5	Inventory :	
Wage deduction	175.0	Stock-Raw Material	87.5
	<u>662.5</u>	Stock-Goods	425.0

		WIP A	20.0	
		WIP B	17.5	
			<u>550.0</u>	
		Debtors	350.0	
		Bank	10.0	910
Total	<u>1,170.0</u>	Total		<u>1,170</u>

Note :—The above is the suggested answer from the question as printed of the three figures for the cost of finished stock completed within Department B are used and amended total value of Rs. 455,000 instead 5,55,000 as printed is taken, the effect will be to increase the closing stock of the WIP Department B and reduce the finished goods closing stock by Rs. 1,00,000.

Problem 267 (Variance Analysis—Price and usage/efficiency). The following information relates to the standard cost and selling price of product Y :

		Rs. per unit (Kg.)
Direct materials	1 kilogramme	8.00
Direct labour	2 hours at Rs. 6 per hour	12.00
Variable overhead	2 hours at Rs. 1.20 per hour	2.40
Fixed overhead		4.00
Production royalty, per kilogramme		<u>0.80</u>
		27.20
Selling and distribution costs at Rs. 2 per kg.		2.00
Total cost		<u>29.20</u>
Sales margin		<u>5.80</u>
Standard selling price		<u>35.00</u>

Variable overhead is deemed to vary with hours worked.

The budget for Period 9, on which the fixed overhead rate per kilogramme was based, was 10,000 kilogrammes. Sales Budget was 7,000 kg. After the standard had been set, the royalty was increased to Rs. 1 per kilogramme.

Actual sales, production and costs for Period 9 were as follows :

Sales	7,000	kilogrammes at Rs. 37 per kg.
Production	8,000	kilogrammes
Costs :		
Direct materials, purchased and used	8,300	kilogrammes at Rs. 7.90 per kg.
Direct wages incurred	17,000	hours at a cost of Rs. 1,07,100
Variable overhead	Rs. 18,800	
Fixed overhead	Rs. 39,000	
Royalties	Rs. 8,000	
Selling and distribution costs	Rs. 12,000	

Assume opening finished goods stock to be nil and the closing stock for both the statements required for (i) and (ii) below is to be valued at standard cost.

You are required to present in columnar format, using two facing pages in the answer book.

- (i) actual revenues and costs;
 (ii) standard revenues and costs;
 (iii) variances analysed into price and usage/efficiency.

Statement showing actual cost, standard cost and variances

Items	Actual		Standard		Variances	
					F	A *
	Rs.		Rs.		Rs.	
Sales	2,59,000		2,45,000		14,000	
Production costs :			Production Costs :			
Direct Material	65,570		64,000	[MPV MUV]	830	2,400
Direct Wages	1,07,100		96,000	[LRV LEV]		5,100 6,000
Variable overhead	18,800		19,200	[VEx. VEff.]	1,600	1,200
Fixed O.H.	39,000		32,000	[F.Ex. FC F.Eff.]	1,000	6,000 2,000
Royalties	8,000		6,400	* (REV)		1,600
	2,38,470		2,17,600			
Closing stock (1/8th)	27,200	2,11,270	27,200	1,90,400		
Opening Profit	47,730		54,600			
Selling & Distribution	12,000		14,000		2,000	
	35,730		40,600		19,430	24,300
						4,870 (A)

For Variance Analysis :

M_1 — Actual cost or material used = 8,300kg. \times Rs. 7.90 = Rs. 65,570

M_2 — Standard cost of material used = 8,300 \times Rs. 8.00 = Rs. 66,400

M_4 — Standard material cost of output = 8,000 units \times Rs. 8 = 64,000

Material Price Variance (MPV) = $M_1 - M_2 = \text{Rs. } 65,570 - 66,400 = 830 (F)$

Material Usage Variance (MUV) = $M_2 - M_4 = \text{Rs. } 66,400 - 64,000 = 2,400 (A)$

L_1 —Actual payment to workers for actual hrs worked = Rs. 1,07,100

L_2 — Payment involved, if the workers had been paid at
 standard rate 17,000 hrs. \times Rs. 6 = 1,02,000

L_5 — Standard Labour Cost of Output = 8,000 units \times 12 = 96,000

Labour Rate Variance (LRV) = $L_1 - L_2 = \text{Rs. } 1,07,100 - 1,02,000 = \text{Rs. } 5,100(A)$

Royalty Exp. Variance

Labour Efficiency Variance (LEV) = $L_2 - L_5$ = Rs. 1,02,000 - 96,000 = Rs. 6,000(A)

VO₁— Actual Variable Overhead incurred **Rs. 18,800**

VO₂— Actual hours worked at standard variable overhead rate
 = 17,000 hrs. × Rs. 1.20 = 20,400

VO₃— Standard variable O.H. for production 8,000 units × Rs. 2.40 = 19,200

Variable O.H. Expenditure Variance (VE_xV) = VO₁ - VO₂
 = Rs. 18,800 - Rs. 20,400 = Rs. 1,600 (F)

Variable O.H. Efficiency Variation (VE_fV) = VO₂ - VO₃
 = Rs. 20,400 - 19,200 = 1,200 (A)

FO₁— Actual fixed overhead incurred = Rs. 39,000

FO₂— Budgeted fixed O.H. for the period = Rs. 40,000

FO₄— Budgeted fixed O.H. for hours worked

(17,000 × (Rs. 40,000 ÷ 20,000 hrs) ÷ 20,000 hrs = 34,000

FO₅ — Standard fixed overhead for production 8,000 × 4 = 32,000

Fixed O.H. Expenditure Variance = FOE_xV = FO₁ - FO₂ = 39,000 - 40,000
 = 1,000(A)

Fixed O.H. Capacity Variance (FOCV) = Rs. 40,000 - 34,000 = 6,000(A)

Fixed O.H. Efficiency Variance (FOE_fV) = Rs. 34,000 - 32,000 = 2,000(A)

SV₁— Actual sales value realised = Rs. 2,59,000

SV₂— Standard sales value of actual sales 7,000 units × 35.00 = 2,45,000

Sales Value Price Variance = Rs. 2,59,000 - Rs. 2,45,000 = Rs. 14,000(F)

Selling and Distribution Expenditure Variance
 = Rs. 12,000 - Rs. 14,000 = 2,000(F)

Royalty Expenditure Variance = Rs. 8,000 - 6,400 = 1,600(A)

Problem 268 (Profit-Volume Chart). JK Limited has prepared a budget for the next twelve months when it intends to make and sell four products, details of which are shown below :

Product	Sales in units (thousands)	Selling price per unit Rs.	Variable cost per unit Rs.
J	10	20	14.00
K	10	40	8.00
L	50	4	4.20
M	20	10	7.00

Budgeted fixed costs are Rs. 2,40,000 per annum and total assets employed are Rs. 5,70,000.

You are required

(a) to calculate the total contribution earned by each product and their combined total contributions;

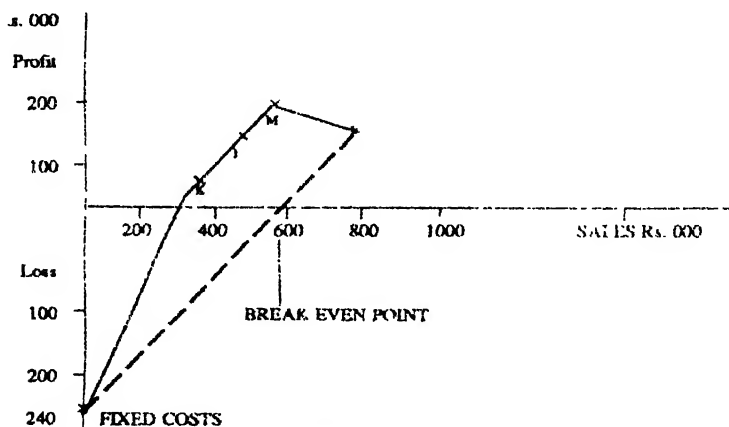
(b) to plot the data of your answer to (a) above in the form of a contribution to sales graph (sometimes referred to as a profit-volume graph) on the graph paper provided; and

(c) to compute the break-even point.

Solution :

Product	Contribution	C.S. Ratio	Product wise contribution (total)	Cumulative contribution	Cumulative contribution less fixed cost
K	32	0.8	3,20,000	3,20,000	80,000
J	6	0.3	60,000	3,80,000	1,40,000
M	3	0.3	60,000	4,40,000	2,00,000
L	(0.20)	(0.05)	(10,000)	4,30,000	1,90,000

$$(c) \text{ BEP} = \frac{\text{Fixed cost}}{\text{Average C/S Ratio}} = \frac{2,40,000}{4,30,000 + 10,00,000} = \text{Rs. } 5,58,140.$$



Problem 269 (Linear Programming). A small firm produces two qualities of a product—Standard and De-Luxe. The contribution per unit is Rs 100 for the Standard and Rs. 300 for the De-Luxe.

Each model requires 1 hour per unit in the machine shop and 40 machining hours are available per week. The Standard model can be assembled and finished in 2.5 hours per unit but the De-Luxe takes 10 hours per unit. There are 200 hours per week available for assembly and finishing.

Market research suggests that the maximum weekly sales of the De-Luxe Model will be 18 units.

The products use a special component, of which only 1,200 are currently available per week. Each Standard unit uses 25 components and each De-Luxe unit needs 50.

(a) You are required to analyse the current position and recommend a weekly production plan, showing its contribution.

Whilst keeping to the De-Luxe Sales limit, the firm would like to maximise contribution and realises that this may mean paying more to increase the supply of some of the resources required. It is not possible to increase the machine hours but assembly hours and the number of components can be increased as follows :

Resource	Additional amount above existing prices to increase supply
Assembly hours	Rs. 12 extra per hour for hours above 200
Component	Rs. 1 extra per component for components above 1,200

You are required :

(b) to assess whether it is worthwhile increasing the supply of assembly hours and components;

(h) to recommend a revised weekly production plan, showing its contribution.

Solution : (a) Formulating the problem as an LP with S = the quantity of Standard produced and D = the quantity of Deluxe produced

We are required to maximise

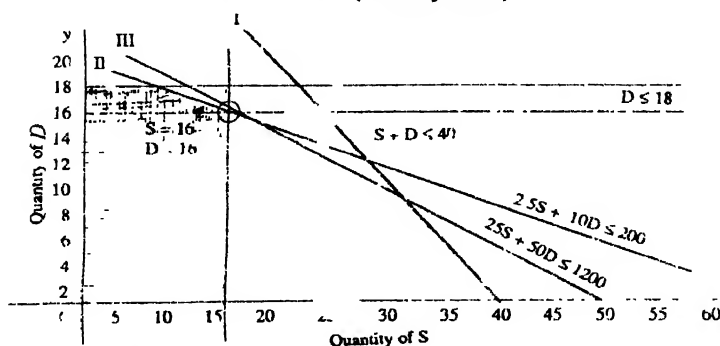
$$100S + 300D \text{ subject to}$$

$$S + D \leq 40 \text{ (Machining hours)}$$

$$2.5S + 10D \leq 200 \text{ (Assembly hours)}$$

$$25S + 50D \leq 1200 \text{ (Components)}$$

$$D \leq 18 \text{ (Weekly sales)}$$



Any point in the shaded portion which will maximize $100C + 300D$ is $S = D = 16$

From the graph, the values of S and D can be easily found out

$$S = 16 \quad D = 16$$

$$\text{Contribution} = 16 \times 100 + 16 \times 300 = \text{Rs. } 6,400$$

This production plan leaves 8 hours machining time available.

(b) Assess whether to increase assembly hours and components. Considering the assembly and constraints only, we are required to maximise

$$100S + 300D \text{ subject to}$$

$$2.5S + 10D \leq 200 \text{ (Assembly hours)}$$

$$25S + 50D \leq 1200 \text{ (Components)}$$

In order to determine the shadow prices we transpose the above to obtain the dual formulation :

Minimise $200A + 1200C$ subject to

$$25A + 25C \geq 100$$

$$10A + 50C \geq 300$$

Solving as simultaneous equations gives $A = 20$, $C = 2$, i.e. these are the maximum amounts we are prepared to pay for extra units of the resource. Since the actual prices are Rs. 12 and Re. 1 respectively, we are prepared to increase the assembly hours and components up to the limit of the machining hours.

(c) *Revised weekly production plan*

We have 8 hours machining time available and each model requires 1 hour, therefore we can produce either 8 Standard or 8 Deluxe, or a combination of the two. The Deluxe also has a restriction of 18 maximum sales.

If 1 extra Standard is produced

Contribution	Rs. 100
Extra assembly costs ($2.5 \times \text{Rs. } 12$)	(30)
Extra component costs ($25 \times \text{Re. } 1$)	(25)
	<hr/> 45

If 1 extra Deluxe is produced

Contribution	Rs. 300
Extra assembly costs ($10 \times \text{Rs. } 12$)	(120)
Extra component costs ($50 \times \text{Re. } 1$)	(50)
	<hr/> 130

Therefore make 2 extra Deluxe (sales restriction of 18) and 6 extra Standard i.e. 18 Deluxe and 22 Standard. Revised contribution.

Standard :	16 @ Rs. 100	Rs. 1,600	
	6 @ Rs. 45	270	
Deluxe :	16 @ Rs. 300	4,800	
	2 @ Rs. 130	260	6,930

✓ **Problem 270 (Joint Probability).** The Managing Director of XYZ plc has devolved some decision making to the operating divisions of the firm. He is anxious to extend this process but first wishes to be assured that decisions are being taken properly in accordance with Group policy.

As a check on existing practice he has asked for an investigation to be made into a recent decision to increase the price of the sole product of Z division to Rs. 14.50 per unit due to rising costs.

The following information and estimates were available for the management of Z division :

Last year 75,000 units were sold at Rs. 12 each with a total unit cost of Rs. 9 of which Rs. 6 were variable costs.

For the year ahead the following cost and demand estimates have been made :

Unit variable costs :

Pessimistic	Probability	0.15	Rs. 7.00 per unit
Most likely	Probability	0.65	Rs. 6.50 per unit
Optimistic	Probability	0.20	Rs. 6.00 per unit

Total fixed costs :

Pessimistic	Probability	0.3	Increase by 50%
Most likely	Probability	0.5	Increase by 25%
Optimistic	Probability	0.2	Increase by 10%

Demand estimates at various prices (units) :

		Price per unit : Rs. 13.50		Rs. 14.50
Pessimistic	Probability	0.3	45,000	35,000
Most likely	Probability	0.5	60,000	55,000
Optimistic	Probability	0.2	70,000	68,000

(Unit variable costs, fixed costs and demand estimates are statistically independent.)

For this type of decision the Group has decided that the option should be chosen which has the highest expected outcome with at least an 80% chance of breaking even.

You are required : (a) to assess whether the decision was made in accordance with Group Guidelines;

(b) to explain what is the Group attitude to risk as evidenced by the guidelines.

Solution : (a) Selling Price Rs. 13.50

Demand	Prob.	Cont./Unit	Prob.	Total Cont.	Joint Prob.	Cum. Jt. Prob.
45,000	0.3	6.50	0.15	2,92,500	0.045	0.045
		7.00	0.65	3,15,000	0.195	0.240
		7.30	0.20	3,28,500	0.060	0.300
60,000	0.5	6.50	0.15	3,90,000	0.075	0.375
		7.00	0.65	4,20,000	0.325	0.700
		7.30	0.20	4,38,000	0.100	0.800
70,000	0.2	6.50	0.15	4,55,000	0.030	0.830
		7.00	0.65	4,90,000	0.130	0.960
		7.30	0.20	5,11,000	0.040	1.000

Selling Price Rs. 14.50

35,000	0.3	7.50	0.15	2,62,500	0.045	0.045
		8.00	0.65	2,80,000	0.195	0.240
		8.30	0.20	2,90,500	0.060	0.300
55,000	0.5	7.50	0.15	4,12,500	0.075	0.375
		8.00	0.65	4,40,000	0.325	0.700
		8.30	0.20	4,56,500	0.100	0.800

68,000	0.2	7.50	0.15	5,10,000	0.030	0.830
		8.00	0.65	5,44,000	0.130	0.960
		8.30	0.20	5,64,400	0.040	1.00

Last year's fixed costs = 75,000 units \times Rs. 3 = Rs. 2,25,000.

Estimated fixed costs	Rs. 2,25,000 \times 1.10 \times 0.2	= Rs. 49,500
	2,25,000 \times 1.25 \times 0.5	1,40,625
	2,25,000 \times 1.50 \times 0.3	1,01,250
		<u>2,91,375</u>

To break-even the contribution must be greater than Rs. 2,91,375. It is noticed from the above tables that at selling price of Rs. 13.50 there is 100% chance to break-even. However, at selling price of Rs. 14.50 there are 70% chance of break-even. The selling price of Rs. 14.50 and therefore, contravenes Group Guidelines.

(b) **Attitude to Risk.** The Group seeks to minimise that down side risk whilst maximising its return. It is to some extent risk averse, but it is prepared to take some risk *i.e.*, 20% risk of loss. It is always sought to maximise its returns, ignoring the probability of failure, it would be risk neutral.

Problem 271 (Capital budgeting—Divisional Performance *vis-a-vis* commercial/ethical appraisal). XYZ plc operates a divisional organisation structure. The performance of each division is assessed on the basis of the Return on Capital Employed (ROCE) that it generates.

For this purpose the ROCE of a division is calculated by dividing its "trading profit" for the year by the "book value of net assets" that it is using at the end of the year. Trading profit is the profit earned excluding extraordinary items. Book value of net assets excludes any cash, bank account balance or overdraft because XYZ plc uses a common bank account (under the control of its head office) for all divisions.

At the start of every year each division is given a target ROCE. If the target is achieved or exceeded then the divisional executives are given a large salary bonus at the end of the year.

In 1991, XYZ plc's division A was given a target ROCE of 15%. On 15th December 1991 A's divisional manager receives a forecast that trading profit for 1991 would be Rs. 1,20,000 and net assets employed at the end of 1991 would be Rs. 8,20,000. This would give an ROCE of 14.6% which is slightly below A's target.

The divisional manager immediately circulates a memorandum to his fellow executives inviting proposals to deal with the problem. By the end of the day he has received the following proposals from those executives (all of whom will lose their salary bonus if the ROCE target is not achieved):

- from the Works Manager : that Rs. 1,00,000 should be invested in new equipment resulting in cost savings of Rs. 18,000 per year over the next fifteen years;
- from the Chief Accountant : that payment of a Rs. 42,000 trade debt owed to a supplier due on 16th December 1991 be deferred until 1st

January 1992. This would result in a Rs. 1,000 default penalty becoming immediately due;

(iii) *from the Sales Manager* : that Rs. 1,500 additional production expenses be incurred and paid in order to bring completion of an order forward to 29th December 1991 from its previous schedule date of 3rd January 1992. This would allow the customer to be invoiced in December, thereby boosting 1991 profits by Rs. 6,000, but would not accelerate customer payment due on 1st February 1992;

(iv) *from the Head of Internal Audit* : that a regional plant producing a particular product be closed allowing immediate sale for Rs. 1,20,000 of premises having a book value of Rs. 90,000. This would result in Rs. 50,000 immediate redundancy payments and a reduction in profit of Rs. 12,600 per year over the next fifteen years;

(a) You are required to assess each of the above four proposals having regard to

- their effect on divisional performance in 1991 and 1992 as measured by XYZ plc's existing criteria;
- their intrinsic commercial merits;
- any ethical matters that you consider relevant.

You should ignore taxation and inflation.

(b) You are required to discuss what action XYZ plc's Finance Director should take when the situation at division A and the above four proposals are brought to his attention.

Solution.

Comments on Proposals for dealing with a forecast reduction in profit compared with target.

(i) *Investment in new equipment-1991*. As only two weeks remain in the forecast period (including Christmas holiday) it is quite unlikely that new equipment could be purchased and installed during the accounting period. If it could be installed, it would have the effect of adding of a very small profit—say Rs. 500 to the numerator and about Rs. 1,00,000 to the denominator. Therefore, it would reduce the Return On Capital Employed (ROCE).

1991—In a full year working, the plan would have the effect of reducing profit by about Rs 7,000 (say Rs. 25,000 additional depreciation on a 25% reducing balance basis less the cost savings of Rs. 18,000) and Rs. 75,000 (Rs. 1,00,000 less 25% depreciation) to the base. This would lower the ROCE.

Commercial Merit—Taking the cash savings of Rs. 18,000 for 15 years at 15% and ignoring taxation, the present value (using the cumulative tables) will be Rs. $18,000 \times 5.85 = \text{Rs. } 1,05,300$. As this is in excess of Rs. 1,00,000, investment in the project is viable using this very basic evaluation.

Ethical Matters—Nothing significant.

(ii) *Deferment of trade debt 1991*—As cash is not included in the net assets, deferment of the trade creditors will have beneficial effect. The denominator would be reduced by Rs. 42,000 and the numerator by Rs. 1,000 default penalty.

$$\text{ROCE} = \frac{\text{Rs. } 1,20,000 - \text{Rs. } 1,000}{\text{Rs. } 8,20,000 - \text{Rs. } 42,000} = 15.3\%$$

Thus, the proposal achieves the 15% target

1992—The deferment will have no effect in the following year.

Commercial Merit—None, because the company profit will be reduced by Rs. 1,000 default penalty only partly offset by any interest on the deferment of cash payment.

Ethical Matters—It is unethical to cause company a loss of Rs. 1,000 to obtain a salary bonus. This act could cause poor relationship with supplier.

(iii) **Earlier completion of an order**

1991—Profit would improve by Rs. 6,000 – Rs. 1,500 = Rs. 4,500 net and the capital employed would be increased by Rs. 6,000

$$\text{ROCE} = \frac{\text{Rs. } 1,24,500}{8,26,000} \times 100 = 15.1\%$$

This would be sufficient to meet the target.

—**1992** profit would be reduced by Rs. 6,000.

Commercial Merit—None, because the overall extra cost of Rs. 1,500 would reflect drop in profit of this amount.

Ethical Matters—It is unethical to cause company a loss of Rs. 1,500 to obtain a salary bonus.

(iv) **Closing a regional plant.**

1991—The ROCE target is based on trading profit, so the profit on the sale of the asset (Rs. 30,000) and redundancy payments of Rs. 50,000 would be included. Perhaps most of the profit of Rs. 12,600 has been made in the current year. If decision is taken in 1991 to close the plant, then the capital employed will be reduced by Rs. 90,000. This will improve the ROCE to :

$$\frac{\text{Rs. } 1,20,000}{\text{Rs. } 8,20,000 - \text{Rs. } 90,000} = 16.4\% \text{ which meets the target}$$

1992—Assuming that asset is fully depreciated, the effect will be to reduce the ROCE numerator by Rs. 12,600 and denominator by Rs. 90,000. This would be equivalent to eliminating an asset with a return of 14%. So remaining ROCE averaging nearly 15% will improve.

Commercial Merit—To continue the plant will entail foregoing Rs. 70,000 (Rs. 1,20,000 less Rs. 50,000 redundancy pay) and to retain will mean Rs. 12,600 per year for 15 years. Ignoring taxation and using a 15% cost of capital the net present value, (using cumulative tables) is Rs. 12,600 × 5.85 = Rs. 73,710. As this is in excess of Rs. 70,000, the plant should be retained.

Ethical Matters—It is unethical to close a plant showing a profitable return in order to obtain a salary bonus. It will mean loss of jobs to employees and inconvenience to customers.

Problem 272 (Selling optimal selling price). (a) **ABC Ltd.** manufactures a wide range of components for use in various industries. It has developed a new component called the Unit. It is the practice of ABC Ltd. to set a "list" selling price for its components and charge this price to all customers. It sells its components direct to customers all over the UK and abroad.

ABC Ltd has surplus capacity available to enable it to produce up to 350,000 Units per year without any need to acquire new facilities or cut back on the production of other products.

Market research indicates that the demand for Units per year will move as follows in response to changes in selling price :

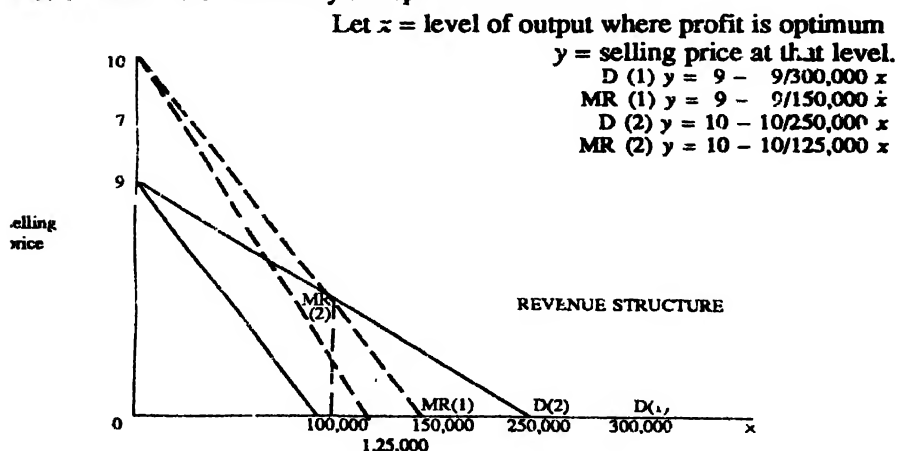
- at a selling price of Rs. 9.00 per Unit, no Units will be sold; however
- for every 3p the selling price is reduced below that figure sales will increase by 1,000 Units until total sales reach 100,000 Units, from which point
- the selling price must be reduced by 4p for each additional 1,000 Units increase in sales.

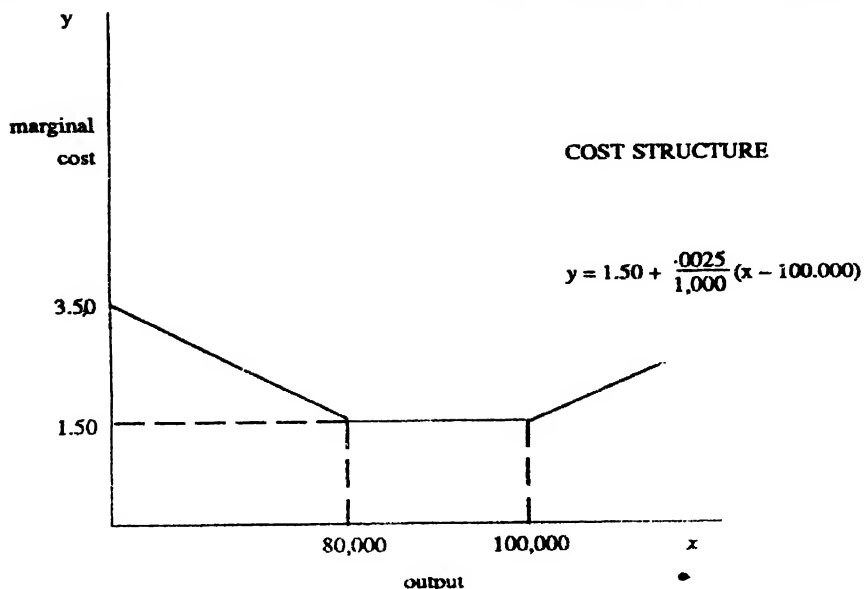
Research into production costs indicates that the “marginal costs” for Unit production in any given year are as follows :

- *Labour* : initially Rs. 2.00 per unit but falling by 2.5p per Unit for each extra 1,000 units produced thus the first 1,000 Units produced incurs a labour cost of Rs. 2,000, the second thousand incurs a labour cost of Rs. 1,975, the third thousand incurs a labour cost of Rs. 1,950 and so on until output reaches 80,000; output can be increased beyond 80,000 units per year without incurring any additional labour costs;
- *materials* : 50p per unit constant at all levels of output;
- *overhead* : initially Rs. 1.00 per unit and remaining constant until output reaches 1,00,000 units per year; the overhead cost per Unit of producing at above that level rises by 0.25p for each extra 1,000 units produced—thus the 101st thousand units produced incurs an overhead cost of Rs. 1,002.50, the 102nd thousand units produced incurs an overhead cost of Rs. 1,005 and so on....

You are required to calculate (accurate to the nearest paise) the selling price per Unit that will maximise ABC Ltd's profit from Unit production.

Solution (a) The cost and revenue structures associated with the production and sale of units may be represented as follows :





Profit is maximised at a level of output above 1,00,000 Units where—

Marginal Cost = Marginal Revenue

That level of output will be where —

$$1.50 + \frac{0.0025}{1,000} (x - 100,000) = 10 - \frac{10}{125,000} x$$

or $x = 106,061$

If profit maximising output (x) is 106,061 then the profit maximising unit selling price (y) must be—

$$y = (10 - \frac{10}{250,000}) \times 106,061$$

$y = \text{Rs. } 5.76.$

Therefore the required selling price to maximise profit is Rs. 5.75 per Unit.

Problem 273 (Choice of a model of truck—Inflation). (a) *DEF* is a transport company whose “cost of money” is 15.5%.

In December 1991 price inflation in the United Kingdom is at a rate of 10% per year and this rate is expected to continue for the next ten year.

In January 1992, *DEF* is considering the purchase of a new truck which will be required to travel 50,000 km per year. Two suitable models are available, details of which are as follows :

Model K, which has a life of 4 years and a price of Rs. 24,000;

The running cost is Re. 0.21 per km. but this figure will rise by Re. 0.05 per km for each year the truck is in service;

A new engine (cost Rs. 6,000) will have to be fitted at the end of the second year in which the truck has been in service;

Model S, which has a life of 6 years and a price of Rs. 42,000;

The running cost is initially Re. 0.18 per km but this figure will rise by 3.6 paise per km for each year the truck is in service.

All costs quoted are at January 1992 price level.

You are required to advise DEF's management as to which truck (model K or Model S) DEF should buy. You should assume that DEF is not in a tax paying position and will not be so during the next ten years. Support your advice with a full financial analysis.

(b) In addition to the information given in (a), you are informed that DEF is now in a tax paying position and is expected to remain so far the next ten years.

There is a 35% tax on corporate profits with "Writing Down Allowances" in respect of equipment being 25% per year on a reducing balance basis. The cost of spare parts is treated as revenue expenditure for tax purposes. Loan interest is fully tax deductible. You may assume that tax is payable twelve months after the end of the financial year in which the associated profits were earned. DEF's financial year ends on 31 December.

You are required to advise DEF's management as to which truck it should buy, incorporating this additional information in your calculations. Support your advice with a full financial analysis.

Solution :

Working Details :

(Rs. '000)

1. Expenses		Model K		Model S	
		Cash flow*	Tax credit for running cost \$	Cash flow	Tax credit for running cost \$
		Rs.	Rs.	Rs.	Rs.
1991	Running costs for 50,000 miles	(10.5)	—	† (9.0)	—
1992	Running costs New Engine	(13.0) (6.0)	3.7	(10.8)	3.2
1993	Running costs	(15.5)		(12.6)	3.7
1994	Running costs	(18.0)	5.4	(14.4)	4.4
1995	Running costs	—	6.3	(16.2)	5.0
1996	Running costs	—	—	(18.0)	5.7
1997	Running costs	—	—	—	6.3

* @ Re. 0.21 per km. but this figure rises by Re. 0.05 per km for each year.

† @ Re. 0.18 per km but this figure rises by Re. 0.036 per km for each year.

\$ Running cost will bring down the profits for the year and hence it will lead to tax credit @ 35% in the subsequent year.

Writing down allowances

(Rs. '000)

Model K		Model S	
Investment	Tax benefit 35%	Investment	Tax benefit 35%
24.0		42.0	
6.0	2.1	10.5	3.7
<u>18.0</u>		<u>31.5</u>	

1992	<u>4.5</u>	1.6	<u>7.9</u>	2.8
	13.5		23.6	
1993	<u>3.4</u>	1.2	<u>5.9</u>	2.1
	10.1		17.7	
1994	<u>10.1 *</u>	3.5	<u>4.4</u>	1.5
1995	—		13.3	1.1
			3.3	
			10.0	
1996			<u>10.0 *</u>	3.5
			—	

*Balancing figure.

Assumption relating to discounting rate. The inflation rate is 10%. The company's cost of money of 15.5% and therefore, is assumed to include the effect of this inflation. The alternative projects are evaluated on a current price level basis using a "real" rate of interest, which is computed as follows :

$$\frac{115.5}{110} \times 100 = 105 \text{ i.e. } 5\%$$

This rate is to be taken for analysis for (a) For finding out cost of capital "after tax adjustment", working is as follows :

After tax cost of capital

$$K_1 = K_d \times (1 - T) \text{ or } 5\% \times (1 - 0.35) = 3.25\%$$

where, K_1 = After tax cost of debt; K_d = Before tax cost of debt ; T = tax rate

(a) *Project evaluation – Choice between Model K and Model S Model K*

(Rs. '000)					
Year	Purchase price	All expenses as per working above	Net Cash flow	DCF factor 5%	Present value
0	(24.0)	—	(24.0)	1.00	(24.0)
1		(10.5)	(10.5)	0.95	(10.0)
2		(19.0)	(19.0)	0.91	(17.3)
3		(15.5)	(15.5)	0.86	(13.3)
4		(18.0)	(18.0)	0.82	(14.8)
			Discounted cost		(79.4)

Annualised cost over 4 years using cumulative DCF factor for 5% of 3.55 :

$$79.4 \div 3.55 = 22.37$$

Model S

Rs. '000

Year	Purchase price	Expenses	Net Cash flow	Discounting factor 5%	Present value
0	(42.0)	—	(42.0)	1.00	(42.0)
1	—	(9.0)	(9.0)	0.95	(8.6)
2	—	(10.8)	(10.8)	0.91	(9.8)
3	—	(12.6)	(12.6)	0.86	(10.8)
4	—	(14.4)	(14.4)	0.82	(11.8)
5	—	(16.2)	(16.2)	0.78	(12.6)
6	—	(18.0)	(18.0)	0.75	(13.5)
Discounted Cost					(109.1)

Annualised cost of 6 years using cumulative DCF factor for 5% of 5.08 :—

$$109.1 \div 5.08 = 21.48$$

Recommendation : From financial view point Model S should be purchased as this has the lowest annualised cost.

Important Note : Readers should note the annualised net present value (ANPV) is the most efficient technique for comparing *mutually exclusive projects with unequal lives*. In this situations, decision based on NPV above shows Model K as the alternative to be selected. This decision will be wrong.

(b) Project evaluations incorporating tax adjustments :

Model K

(Rs. '000)

Year	Pre-tax net cash flow	Tax credit for writing down allowances*	Tax credit for running cost, which will bring income down	Post-tax net cash flow	DCF factor 3.25% \$	Discounted cash flow
0	(24.0)	—	—	(24.0)	1.00	(24.0)
1	(10.5)	—	—	(10.5)	0.97	(10.2)
2	(19.0)	2.1	3.7	(13.2)	0.93	(12.3)
3	(15.5)	1.6	6.6	(7.3)	0.91	(6.6)
4	(18.0)	1.2	5.4	(11.4)	0.88	(10.0)
5	—	3.5	6.3	(9.8)	0.85	(8.3)
						(54.8)

Annualised cost over 4 years using cumulative DCF factor for 3.25% of 3.69 :
 $54.8 \div 3.69 = 14.85$.

Model S

(Rs. '000)

Year	Pre-tax net cash flow	Tax credit for writing down allowances *	Tax credit for running cost, which will bring income down	Post-tax net cash expenses	DCF factor 3.25% \$	Discounted cash flow
0	(42.0)	—	—	(42.0)	1.00	(42.0)
1	(9.0)	—	—	(9.0)	0.97	(8.7)
2	(10.8)	3.7	3.2	(3.9)	0.93	(3.6)
3	(12.6)	2.8	3.7	(6.1)	0.91	(5.6)
4	(14.4)	2.1	4.4	(7.9)	0.88	(7.0)
5	(16.2)	1.5	5.0	(9.7)	0.85	(8.2)
6	(18.0)	1.1	5.7	(11.2)	0.83	(9.3)
7	—	3.5	6.3	9.8	0.80	7.8
						(76.6)

Annualised cost over 6 year using cumulative DCF factor for 3.25% of 5.37 : $76.6 + 5.37 = 14.26$.

Recommendation—From a financial view point Model S should still be purchased, as it has lower annualised cost.

* Refer to "working-details" in the beginning at serial no. 2

\$ Refer to note 1 below.

Note 1 : Discounting factors for the rate 3.25% have been obtained by interpolation between those of 3% and 4% as follows :

S No	Year	0	1	2	3	4	5	6	7
1.	Discounting factors at 3% for 3 years	1.0	0.971	0.943	0.915	0.888	0.863	0.837	0.813
2.	Discounting factors at 4% for 3 years	1.0	0.962	0.925	0.889	0.855	0.822	0.790	0.760
3.	1/4th of difference of 1%	—	0.002	0.004	0.007	0.008	0.010	0.011	0.013
4.	Discounting factor at 3.25% for 3 years		0.969	0.939	0.908	0.88	0.853	0.826	
	(1 - 3)		or	or	or	or	or	or	
			0.97	0.93	0.91		0.85	0.83	0.80

Note 2 : Similarly factors for annualised cost have been obtained by interpolation but these table to be used will be :

PV 'for Rs. 1 annuity for n period'

i.e. for 3% for 4 years

for 4% for 4 years

..... 3.717

..... 3.630

= 3.717 - (4 of 0.087)

= 3.695 or 3.69

Problem 274 (Investigation of variances). The following analysis is available for the month of April for Department A :

Standard direct materials	Rs. 72,000	
Material usage variance	3,500	unfavourable
Material price variance	1,000	unfavourable
Material mix variance	2,500	unfavourable

The following estimates have also been made for Department A :

Estimated cost of investigating the total material variance	Rs. 1,000
Estimated cost of correcting the total variance if investigated and found to be out of control	2,000
Estimated cost of permitting out-of-control material variances to continue	10,000

Maximum Probability of a given total variance :

Probability	0.99	0.98	0.96	0.93	0.89	0.85	0.8	0.75
Total Variance '000	1	2	3	4	5	6	7	8

You are required determine, using a payoff table, whether the variance should be investigated.

(b) You are uncertain of the estimated probability in (a).

Calculate the probability estimate at which you would be indifferent between investigating and not investigating the variance.

Solution :

(a) Probability of variances being Rs. 7,000 under control = 0.8

\therefore Probability of a variances being out of control = $1 - 0.8 = 0.2$

A -- Cost of decision to investigate :

(i) Estimated cost of decision to investigate, which will be incurred anyway, if this decision is taken = Rs. 1,000

(ii) Estimated cost of correcting the total variances if investigated and found to be out of control Rs. 2,000 \times 0.2 = 400

Total cost of decision to investigate 1,400

B Cost of decision to permit the out-of-control material variances to continue : Rs. 10,000 \times 0.2 = Rs. 2,000

Conclusion : Since cost at A < cost at B, it is in the interest of the company to investigate.

(b) Let p be the probability at which the company will be indifferent to investigating or not investigating.

Therefore cost of investigation + cost of correction $(1 - p)$ = cost of allowing the situation to go out of control $(1 - p)$

By plotting the values Rs. 1,000 + 2,000 $(1 - p)$ = 10,000 $(1 - p)$

or $p = 7 + 8 = 0.875$.

Appendix B

Preparing for Professional Examinations

In professional examinations, emphasis is on testing comprehension, self expression and managerial ability to apply knowledge in divergent situations. Repetition is often avoided. Problems set in examinations are often lengthy, trickish and demanding in nature. Success in these examinations considerably depends on style of preparation which should have perseverance, regularity of efforts, thorough practice, vision and objectivity. To add to readers approach, following tips are given based on personal experience.

1. *Plan well.* The student must envisage the whole exercise of preparation before starting the actual work. The time span available for examination should be broken in four stages i.e., (i) Planning Stage, (ii) Exhaustive study stage (iii) Revision stage and (iv) Examination Hall. You can go as far as possible in consulting books and doing work in first two stages. In the last two stages you have to concentrate, on work done to improve your confidence work in first two stages has been done well.

2. *Start from syllabus and analyse the trends.* Syllabus is always the starting point. Questions that appeared in last ten terms must be analysed and a trend must be determined to give direction to your activities. *Even this book contains trend analysis* relating to your examination. This insight will help you to identify areas demanding extra emphasis. After consulting syllabus and analysis of last years' *re d*, the "*work to be done*" must be expressed in terms of well defined *specific activities*. The aggregate of these activities is all, that you are going to do for the examination.

3. *Time-Schedule.* It is essential for time-management. It will differ from individual to individual. Time-schedule, which should be strictly adhered to, should provide for follow up of activities, necessary corrections and additions as the implementation process for execution of specified activities makes progress. Linking of time-schedule with specified activities will help you to avoid procrastination, which primarily thives away the time.

4. *Divide the work in different categories.* The work to be done by students should be divided in different categories as follows :

A Category may include activities requiring maximum efforts, reference to different books and a specialised guidance of a friend or an expert. Single out these activities and give them the appropriate treatment. This may include typical problems and concepts.

B Category may include those activities where your own efforts will adequately do the job for you. This may include familiarisation with all the terms relevant for the purpose, practising the problems at regular intervals and preparation of notes.

C Category will include those activities in which action has already been done but follow up is to be kept to maintain lively association with the subject regularly. These activities will save time in

examination hall and time thus saved can be used to concentrate on complex problems. This exercise can be done when a student has thoroughly familiarised himself with all the specific activities mentioned in B category.

5. *Clarity of concept and self expression* is essential for success. Clarity of concept is different from cramming, which exerts avoidable strain on the student. Capacity to express the term in own is what a student should strive for. Expecting an exact reproduction of words used by an Institute to define a term is to be discouraged. Points that will help you are : (i) Write down almost all terms in your own words and read them regularly as a matter of routine, (ii) put your own reproduction of words to test by (a) comparing them with the explanations given by different authorities and (b) using them in examination papers of last ten terms and (iii) simple expression is effective expression. Emphasise expression in simple words.

6. *Search for the approach from within the problem.* (i) While you read, go on making a sketch and write down the facts/data available (ii) then proceed from what you have to what is required (iii) the whole problem and its magnitude may frighten you. Go ahead bit by bit. Your early experience will also help in unfolding the mystery within the problem. (iv) Whenever correct approach is different from your own approach, think and write down the reasons. Look straight into the problem. Remember that nothing will guide you more than the problem itself.

7. *Diagnose yourself well.* Three factors, that immensely dissipate efforts of readers are indecision, inactivity and lack of hope. All these factors indicate poor preparation. The sequence of activities, that you have to attempt, must be clear to you like a neon sign in a dark night. If your preparation is good, problem will not frighten you. It will compel you to concentrate to find the solution. Reviewing your work daily by writing diary will be of immense help in attempting your realistic diagnosis.

8. *General points.* (i) Brevity and good hand writing, (ii) Effective arrangement and presentation, (iii) Logical arrangement. (iv) Clear and concise English, (v) Answers to problem may differ due to assumptions which would be clearly specified. (iv) Write conclusion after analysis of problem in examination, and (vii) Develop the habit of reading the question well, underlining and understanding the specific requirements (viii) Improve your speed by practice and revision to be able to attempt all questions in limited time.

V.K. Sexena
C.D. Vashist

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K. Saxena
M.Com., A.I.C.W.A.
Manager (Cost)
Bharat Heavy Electricals Ltd
Corporate Office, Asiad Village
New Delhi

C.D. VASHIST
M.Com., F.I.C.W.A., I.C.A.S.
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V.K. SAXENA
M. Com., FICWA
Manager (Cost)
Bharat Heavy Electricals Ltd.,
Corporate Office, Asiad Village
New Delhi.

C.D. VASHIST
M.Com., F.I.C.W.A., I.C.A.S.
Director (Cost)
Department of Company Affairs
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CONTENTS

	<i>Pages</i>
1. Overview of Cost Audit	24
2. The Cost Auditor	32
3. Preparing for Cost Audit, Audit Procedures and Techniques	16
4. Cost Audit in EDP Environment	12
5. Internal Control and Internal Audit	19
6. Cost Audit and Companies Act, 1956	32
7. Cost Accounting Records Rules	58
8. Commentary on Cost Accounting (Report) Rules	55
9. Cost Audit Leading to Other Services	19
10. Problems with Suggested Answers	102
11. Management Audit	50
12. Miscellaneous (Section I and Section II)	77
Preface, Contents, Index etc.	42

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• **V.K. Saxena,**

M. Com. A.I.C.W.A.

Manager (Cost)

Bharat Heavy Electricals Ltd.

Corporate Office, Asiad Village

New Delhi

By

C.D. VASHIST

M.Com., F.I.C.W.A., I.C.A.S.

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Contents

S. No.	Chapter	No. of Examples	No. of Solved Problems	No. of Pages			
				Text	Problems	Exercises	Total
1.	Cost Book keeping	13	11	56	29	13	98
2.	Job Costing and Contract Costing	11	27	43	45	10	98
3.	Process Costing	18	23	64	54	8	126
4.	Operating Costing	5	18	20	38	8	66
5.	Joint Products and By Products	16	14	34	30	9	73
6.	Marginal Costing and CVP Analysis	27	66	64	131	13	208
7.	Short-term Decision Making	22	60	54	151	11	216
8.	Budgetary Control	14	35	78	92	19	189
9.	Standard Costing	19	38	100	85	12	197
10.	Uniform Costing	—	—	14	—	2	16
11.	Reporting and Data Processing	—	—	23	—	4	27
12.	Product Pricing	12	26	60	61	6	117
13.	Miscellaneous	—	—	46	—	4	50
14.	Inflation Accounting	6	9	15	23	3	41
15.	Human Resource Accounting	—	—	7	—	1	8
16.	Mathematical Application to Managerial Problems	24	38	52	65	3	120
	Contents, trend, analysis, etc.	—	—	34	—	—	34
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Advanced Cost and Management Accounting—Text CONTENTS

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			<i>Text</i>	<i>Exercises</i>	<i>Total</i>
1.	Introduction	—	24	2	26
2.	Material	20	90	6	96
3.	Labour	18	73	9	82
4.	Overheads	16	93	15	108
5.	Cost Book-keeping	13	56	13	69
6.	Job Costing & Contract Costing	11	43	10	53
7.	Process Costing	18	64	8	72
8.	Operating Costing	5	20	8	28
9.	Joint Products & By-Products	16	34	9	43
10.	Marginal Costing & C.V.P. Analysis	27	64	13	77
11.	Short-term Decision Making	22	54	11	65
12.	Budgetary Control	14	78	19	97
13.	Standard Costing	19	100	12	112
14.	Uniform Costing	—	14	2	16
15.	Reporting & Data Processing	—	23	4	27
16.	Product Pricing	12	56	6	56
17.	Miscellaneous	—	46	4	50
18.	Inflation Accounting	6	15	3	18
19.	Human Resource Accounting	—	7	1	8
20.	Mathematical Applications to Managerial Problems	24	52	3	55
21.	Cost Audit & Management Audit	—	32	7	39
22.	Capital Budgeting	6	37	7	44
	Contents, Trend Analysis				
	Appendix etc.	—	89	—	89
	TOTAL	247	1158	172	1330

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(Problems and Solutions)

[For C.A. Inter, I.C.W.A. Inter, C.S. Inter,
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Summary of Formulae/Steps	—	10
1. Materials	29	47
2. Labour	26	29
3. Overheads	50	77
4. Cost Book-keeping	15	32
5. Job Costing etc.,	30	46
6. Process Costing	24	43
7. Operating Costing	11	15
8. Joint Products & By-products	12	15
9. Marginal Costing & CVP Analysis	50	72
10. Decision Making	12	18
11. Budgetary Control	16	30
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Preface, Contents etc.	—	26
	302	508

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